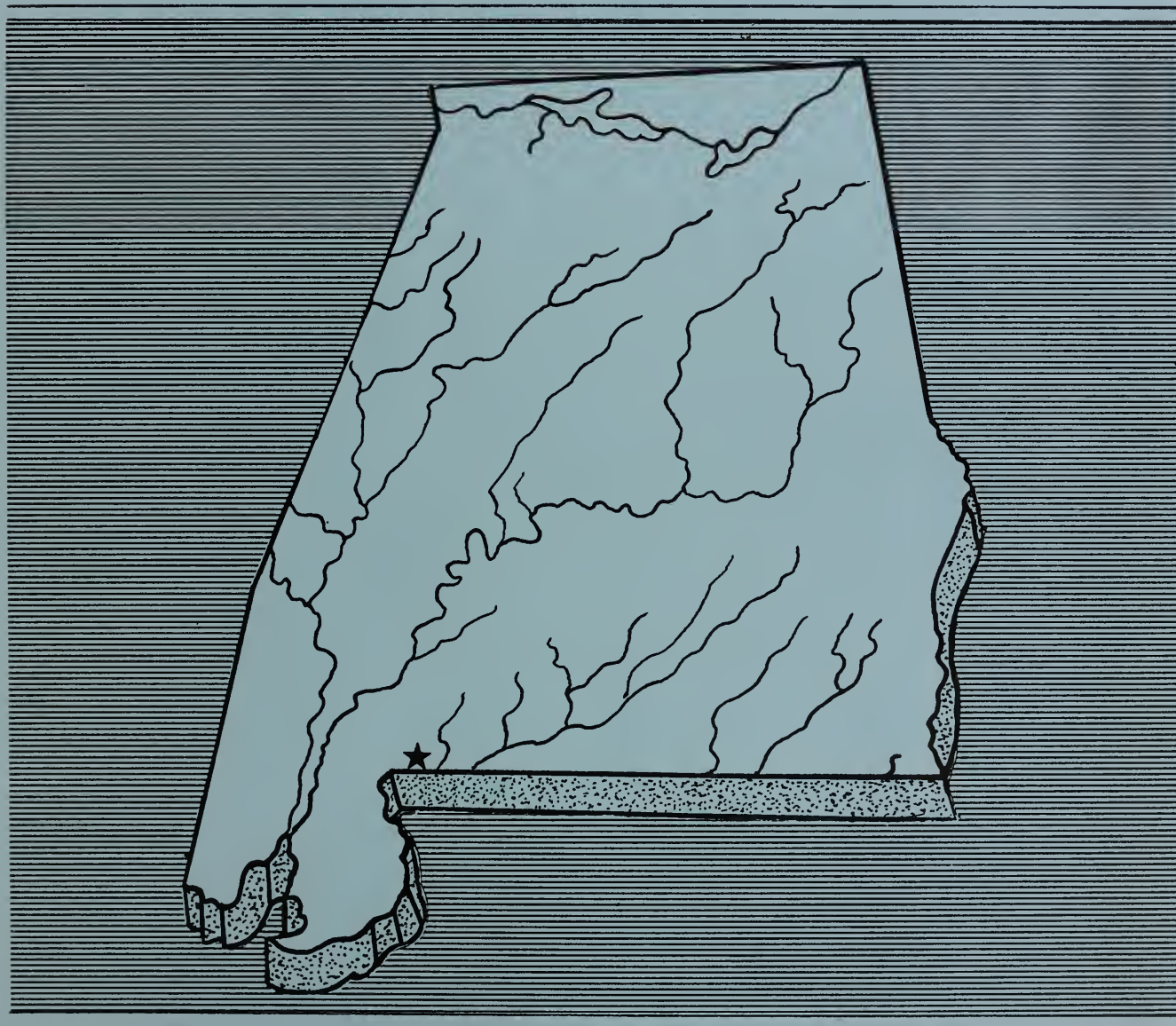


Historic, Archive Document

Do not assume content reflects current scientific knowledge, policies, or practices.

WATERSHED WORK PLAN
FOR
WATERSHED PROTECTION AND FLOOD
PREVENTION
UPPER BRUSHY CREEK



ESCAMBIA COUNTY
ALABAMA
MAY 1975

AD-93 Bookplate
(1-63)

NATIONAL

**A
G
R
I
C
U
L
T
U
R
A
L**



LIBRARY

WATERSHED WORK PLAN

Upper Brushy Creek Watershed

Escambia County, Alabama

Prepared under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended.

Prepared by: Escambia County Soil and Water
Conservation District

Escambia County Commission

City of Atmore, Alabama

With assistance by: U. S. Department of Agriculture
Soil Conservation Service

U. S. Department of Agriculture,
Forest Service

May 1975

U. S. DEPT. OF AGRICULTURE
NATIONAL AGRICULTURAL LIBRARY

JUN 8 1976

CATALOGING - PREP.

ADDENDUM

UPPER BRUSHY CREEK WATERSHED

Escambia County, Alabama

May 1975

The purpose of this addendum is to include in the work plan certain requirements of the Principles and Standards which are: Part I - Benefit to cost comparisons; Part II - Abbreviated four account displays; and Part III - Abbreviated Environmental Quality Plan.

PART I

The work plan contains project costs, benefits, and benefit-cost ratios based on a 5 7/8 percent interest rate, current normalized prices and a 1973 price base. Annual project costs, benefits, and benefit-cost ratios are as follows:

1.	Project costs	\$31,400
2.	Project benefits	\$67,400
3.	Project benefits without secondary	\$62,250
4.	Project benefit-cost ratio	2.1:1.0
5.	Benefit-cost ratio without secondary	2.0:1.0

PART II

Selected Plan

NATIONAL ECONOMIC DEVELOPMENT ACCOUNT

<u>Components</u>	<u>Measures of Effects</u> ^{1/}	<u>Components</u>	<u>Measures of Effects</u> ^{1/}
Beneficial effects:		Adverse effects:	
A. The value to users of increased goods and services.		A. The value of resources required for a plan.	
1. Flood prevention and drainage	\$55,250	1. Excavated earth channel	
2. Utilization of unemployed and underemployed labor resources		a. Project installation (Structural measures)	\$25,700
Project construction and operation & maintenance	7,000	b. Administration	3,500
		c. Operation & Maintenance	2,200
Total beneficial effects	\$62,250	Total adverse effects	31,400
		Net beneficial effects	\$30,850

^{1/} Average annual

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT

<u>Components</u>		<u>Measures of Effects</u> ^{1/}		<u>Components</u>		<u>Measures of Effects</u> ^{1/}	
		State of Alabama	Rest of Nation		State of Alabama	Rest of Nation	
A. Income:				A. Income:			
Beneficial effects:				Adverse effects:			
1.	The value of increased output of goods and services to users residing in the region.			1.	The value of resources contributed from within the region to achieve the outputs.		
a.	Flood prevention and drainage	\$55,250	---		Excavated earth channel.		
b.	The utilization of regional unemployed or underemployed labor resources (Project construction and O&M)	7,000	---	a.	Project installation (Structural measures)	\$ 5,600	\$20,100
				b.	Administration	500	3,000
				c.	Operation & Maintenance	2,200	---
2.	The value of output to users residing in the region from external economics			Total adverse effects		\$ 8,300	\$23,100
a.	Secondary	5,150	---	Net beneficial effects		\$59,100	-\$23,100
Total beneficial effects		\$67,400	---				

^{1/} Average annual

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT - (Continued-2)

<u>Components</u>	<u>Measures of Effects</u>		<u>Components</u>	<u>Measures of Effects</u>	
	State of Alabama	Rest of Nation		State of Alabama	Rest of Nation
B. Employment			B. Employment		
Beneficial effects:			Adverse effects:		
1. Increase in the number and types of jobs			Net beneficial effects		
a. Employment for project construction	14 semi-skilled jobs during the two years of channel construction	---		14 semi-skilled jobs during the two years of channel construction.	---
b. Employment for operation & maintenance	0.5 permanent unskilled job <u>1/</u>	---		0.5 permanent unskilled job. <u>1/</u>	---

1/ Average annual

Selected Plan

REGIONAL DEVELOPMENT ACCOUNT - (Continued-3)

<u>Components</u>	<u>Measures of Effects</u>	
	State of Alabama	Rest of Nation
C. Population distribution		
Beneficial effects	Create 14 semi-skilled jobs during two year structural measure installation period and 0.5 permanent <u>1/</u> job in an area that has experienced a 1.5 percent increase in population from 1960 to 1970.	---
Adverse effects	---	---
D. Regional economic base stability		
Beneficial effects	Reduce floodwater damages and provide drainage outlets on 1,540 acres of agricultural land and 430 acres of urban land. Create 14 semi-skilled short-term jobs and 0.5 permanent unskilled job in an economically depressed area. <u>1/</u>	---
Adverse effects	---	---

1/ Average annual

Selected Plan

SOCIAL WELL-BEING ACCOUNT

<u>Components</u>	<u>Measures of Effects</u>
Beneficial and adverse effects:	
A. Real income distribution	<ol style="list-style-type: none">1. Create 14 man years of semi-skilled employment during two years of channel work and 0.5 permanent unskilled job.2. Create an average annual regional^{1/} income benefit distribution of \$62,2503. Local average annual costs to be borne by region total \$8,300.
B. Life, health and safety	<ol style="list-style-type: none">1. Improve drainage and reduce flood damages by about 75 percent on 1,540 acres of agricultural land and 430 acres of urban land. Flooding will be reduced at nine residences within the urban area. Stream pollution will be reduced by eliminating "dump" sites.
C. Recreational opportunities	<ol style="list-style-type: none">1. Salvage 284 annual visitor days to a city park by reducing flooding.

^{1/} The realization of damage reduction benefits is considered to occur in the watershed area. Average annual secondary benefits of \$5,150 will occur outside the area.

PART III

ABBREVIATED ENVIRONMENTAL QUALITY PLAN

Upper Brushy Creek Watershed, Alabama

The goals of this environmental quality plan for the Upper Brushy Creek Watershed are to preserve and enhance areas of natural beauty; maintain and improve the quality of the water, land, and air resources; and preserve and enhance the biological resources and ecosystems of the watershed so that man can live in an aesthetically and culturally pleasing environment.

The principal environmental quality problems in the watershed are the deterioration of the land, plant, and water resources associated with intensified agricultural use, and an associated nuisance problem in the urban area caused by frequent flooding and inadequate drainage.

The watershed covers an area of 10,980 acres located in southwest Escambia County, Alabama. Topography ranges from nearly level to gently sloping. The watershed is highly agricultural with about 51 percent of the area being used for cropland. Flooding and drainage problems have reduced both the quality and quantity of row crops produced. Past clearing of pine stands for row crop production has reduced the wildlife habitat in the area. Sheet erosion contributes to the sediment loads carried by the stream and reduces water quality. Trash dumps within the urban area further reduce water quality. Flooding and inadequate drainage in the urban area cause a nuisance problem and also damages fixed improvements. Flooding of a city park causes physical damage and reduces visitor day participation.

Component needs for solving problems relating to specific environmental conditions are listed below:

1. Areas of Natural Beauty
 - a. Reduce sheet erosion.
 - b. Remove trash dump sites from stream.
 - c. Preserve and maintain natural, Cypress wetlands.
2. Quality of Water, Land, and Air Resources
 - a. Improve streamflow quality by reducing concentrations of suspended sediment.
 - b. Eliminate water pollution by removing trash dump sites.
 - c. Protect the land resource base from deterioration by reducing flooding and erosion.
 - d. Reduce flood damages to urban dwellings and city park.
 - e. Provide flood protection and drainage outlets on the agricultural area.
3. Biological Resources and Ecosystems
 - a. Preserve and enhance the habitat for the endangered and threatened Dusky Gopher Frog, Flatwoods Salamander, River Frog, Florida Pine Snake, and Rainbow Snake.
 - b. Preserve and maintain natural cypress wetlands for wildlife habitat.
 - c. Create and maintain upland game habitat.

The plan elements for environmental quality consists of management practices, conservation land treatment measures, and about seven miles of channel excavation. Land treatment measures are planned to reduce erosion, provide agricultural drainage, provide wildlife food and cover, and beautify the area. Channel

excavation will reduce flood damages and provide drainage outlets on about 1,540 acres of agricultural land and 430 acres of urban land.

Natural cypress wetlands would be managed by the county or state for wildlife habitat and specifically for habitat or rare and endangered species. These areas would not be drained by channel work and vegetation would be managed to provide wildlife food and shelter.

Land users would be encouraged to apply and maintain conservation land treatment measures by the local soil and water conservation district. Financial assistance is available through programs such as the new Rural Environmental Conservation Program administered by the Agricultural Stabilization and Conservation Service.

Sanitary facilities would be installed at points of public access to prevent possible stream pollution by trash or garbage. This element would be implemented by the city or county governments.

The estimated installation costs of the elements of the environmental quality plan are as follows:

- | | |
|--|-----------|
| 1. Conservation land treatment measures: | \$162,000 |
| 2. Seven miles of channel excavation: | \$475,000 |
| 3. Natural cypress wetlands management: | \$ 20,000 |
| 4. Sanitary facilities at points of public access: | \$ 5,000 |

The total installation cost of implementing the environmental quality plan is estimated to be \$662,000.

The environmental effects that would result from implementing the environmental plan are as follows:

1. Areas of Natural Beauty

- a. Enhance the appearance of 60 farms, 9 dwellings, and a city park by reducing flooding and providing drainage outlets.
- b. Improve the scenic quality of eroded areas.
- c. Improve the scenic value of the stream by eliminating dump sites.
- d. Reduce aesthetic value of the stream during and soon after construction.

2. Quality of Water, Land and Air Resources

- a. Reduce the sediment load carried by the stream.
- b. Improve water quality by eliminating dump sites.
- c. Prevent the deterioration of the land resource base by providing protection from erosion by installing conservation land treatment measures.
- d. Reduce flooding and improve drainage on 1,540 acres of agricultural land and 430 acres of urban land.

3. Biological Resources and Selected Ecological Systems

- a. Create and maintain upland wildlife food and cover through conservation land treatment.
- b. Preserve and maintain natural cypress wetlands for wildlife habitat.
- c. Manage habitat for rare and endangered species.

4. Irreversible and Irretrievable Commitments

- a. The excavated channel will permanently occupy 20 acres of land; of which 4 acres is cropland, 5 acres pastureland, and 11 acres forest land.
- b. Labor, materials, and energy for installation of the project measures.

Selected Plan

ENVIRONMENTAL QUALITY ACCOUNT

- | | |
|---|--|
| A. Areas of natural beauty | <ol style="list-style-type: none">1. Funds and resources will be available to enhance the physical appearance of 60 farms and nine dwellings within the area served by the channel.2. The removal of excess water will add to the scenic beauty of 1,970 acres in the water problem area. Conservation land treatment measures will add to the scenic beauty of the entire watershed.3. Visual quality of the area will be reduced by the removal of trees and excavation during the construction process. |
| B. Quality considerations of water and land resources | <ol style="list-style-type: none">1. Reduce erosion and soil loss by 34 percent on cropland and 33 percent on pastureland.2. Reduce sediment deposition at the mouth of the watershed.3. Reduce pollution from garbage dump sites.4. Increase suspended sediment concentrations in the stream during construction of the channel. |
| C. Biological resources and selected ecosystems | <ol style="list-style-type: none">1. Wildlife food and cover will be supplied by vegetation planted on the spoil areas.2. Removal of trees and underbrush for project installation.3. Modification of 7.2 miles of stream system by channel excavation. |
| D. Irreversible and irretrievable commitments | <ol style="list-style-type: none">1. Twenty acres of agricultural land will be committed to the channel; 4 acres cropland, 5 acres pastureland, and 11 acres forest land.2. Removal of trees now bordering stream channel.3. Labor, materials, and energy for construction of project measures. |

TABLE OF CONTENTS

	<u>Page</u>
WATERSHED WORK PLAN AGREEMENT.	I
SUMMARY OF PLAN.	1
WATERSHED RESOURCES - ENVIRONMENTAL SETTING.	3
Physical Resources.	3
Physical Data.	3
Soils and Land Capabilities.	3
Geology and Topography	6
Climate.	7
Minerals and Ground Water Resources.	7
Land Use	7
Surface Water Resources.	8
Present and Projected Population.	10
Economic Resources.	10
Plant Resources	12
Fish and Wildlife Resources	14
Recreational Resources.	16
Archaeological, Historical and Unique Scenic Areas.	17
Soil, Water and Plant Management Status	17
References Cited.	20
WATER AND RELATED LAND RESOURCE PROBLEMS	21
Land Treatment.	21
Floodwater and Drainage	22
Erosion Damage.	24
Sediment Damage	24
Municipal and Industrial Water.	25
Recreation.	25
Water Quality	25
Economic and Social	26
References Cited.	27
PROJECTS OF OTHER AGENCIES	28
PROJECT FORMULATION.	29
Objectives.	29
Environmental Considerations.	30
Alternatives.	31
Conclusions	33
WORKS OF IMPROVEMENT TO BE INSTALLED	34
Land Treatment Measures	34
Structural Measures	37
References Cited.	41

EXPLANATION OF INSTALLATION COSTS.	42
Land Treatment.	42
Channel Work.	42
EFFECTS OF WORKS OF IMPROVEMENT.	44
Flood Prevention, Erosion and Sediment.	44
Fish and Wildlife	47
Archaeological, Historical and Unique Scenic Areas.	48
Economic and Social	48
Other	49
References Cited.	50
PROJECT BENEFITS	51
COMPARISON OF BENEFITS AND COSTS	52
PROJECT INSTALLATION	53
Land Treatment Measures	53
Structural Measures	53
FINANCING PROJECT INSTALLATION	56
PROVISIONS FOR OPERATION AND MAINTENANCE	57
TABLES	
Table 1 - Estimated Project Installation Cost	59
Table 1A - Status of Watershed Works of Improvement.	60
Table 2 - Estimated Structural Cost Distribution.	61
Table 2A - Cost Allocation and Cost Sharing Summary.	62
Table 3 - Structure Data (Channels)	63
Table 3A - Grade Stabilization Structure	64
Table 4 - Annual Cost	65
Table 5 - Estimated Average Annual Flood and Drainage Damage Reduction Benefits.	66
Table 6 - Comparison of Benefits and Costs for Structural Measures	67
INVESTIGATIONS AND ANALYSES.	68
Conservation Land Treatment	68
Hydraulic and Hydrologic.	68
Engineering	69
Economics	70
Fish and Wildlife	71
Sedimentation	71
Archaeological and Historical Values.	72
FIGURES	
Figure 1 - Project Map	
Figure 2 - Land Use Map	
Figure 3 - Soils Map	
Figure 4 - Typical Reinforced Drop Spillway	

WATERSHED WORK PLAN AGREEMENT

between the

Escambia County Soil and Water Conservation District

Escambia County Commission

City of Atmore

(hereinafter referred to as the Sponsoring Local Organization)

State of Alabama

and the

Soil Conservation Service

United States Department of Agriculture

(hereinafter referred to as the Service)

Whereas, application has heretofore been made to the Secretary of Agriculture by the Sponsoring Local Organization for assistance in preparing a plan for works of improvement for the Upper Brushy Creek Watershed, State of Alabama, under the authority of the Watershed Protection and Flood Prevention Act (P. L. 566, 83rd Congress; 68 Stat. 666), as amended; and

Whereas, the responsibility for administration of the Watershed Protection and Flood Prevention Act, as amended, has been assigned by the Secretary of Agriculture to the Service; and

Whereas, there has been developed through the cooperative efforts of the Sponsoring Local Organization and the Service a mutually satisfactory plan for works of improvement for the Upper Brushy Creek Watershed, State of Alabama, hereinafter referred to as the watershed work plan, which plan is annexed to and made a part of this agreement;

Now, therefore, in view of the foregoing considerations, the Sponsoring Local Organization and the Secretary of Agriculture, through the Service, hereby agree on the watershed work plan, and further agree that the works of improvement as set forth in said plan can be installed in about five years.

It is mutually agreed that in installing and operating and maintaining the works of improvement substantially in accordance with the terms, conditions, and stipulations provided for in the watershed work plan:

1. The Sponsoring Local Organization will acquire, with other than PL-566 funds, such land rights as will be needed in connection with the works of improvement. (Estimated Cost \$43,500).

2. The sponsoring local organization assures that comparable replacement dwellings will be available for individuals and persons displaced from dwellings, and will provide relocation assistance advisory services and relocation assistance, make the relocation payments to displaced persons, and otherwise comply with the real property acquisition policies contained in the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646, 84 Stat. 1894) effective as of January 2, 1971, and the Regulations issued by the Secretary of Agriculture pursuant thereto. The costs of relocation payments will be shared by the sponsoring local organization and the Service as follows:

Item	Sponsoring Local Organization (percent)	Service (percent)	Estimated Relocation Payment Costs (dollars)
Relocation Payments	34.4	65.6	0 <u>1</u> /

3. The Sponsoring Local Organization will acquire or provide assurance that landowners or water users have acquired such water rights pursuant to state law as may be needed in the installation and operation of the works of improvement.
4. The percentages of construction costs of structural measures to be paid by the Sponsoring Local Organization and by the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Construction Cost (dollars)
Channel Work	13.75	86.25	370,000

The Sponsoring Local Organization will perform a portion of the channel excavation under a Performance of Work arrangement. The quantity and value of this work will be determined by mutual agreement immediately prior to the signing of the appropriate agreement and will be set forth in the project agreement.

- 1/ Investigation has disclosed that under present conditions the project measures will not result in the displacement of any person, business, or farm operation. However, if relocations become necessary, relocation payments will be cost-shared in accordance with the percentages shown.

5. The percentages of the engineering costs to be borne by the Sponsoring Local Organization and the Service are as follows:

Works of Improvement	Sponsoring Local Organization (percent)	Service (percent)	Estimated Engineering Cost (dollars)
Channel Work	0	100	22,200

6. The Sponsoring Local Organization and the Service will each bear the costs of Project Administration which it incurs, estimated to be \$8,200 and \$51,000 respectively.
7. The Sponsoring Local Organization will provide assistance to landowners and operators to assure the installation of the land treatment measures shown in the watershed work plan.
8. The Sponsoring Local Organization will encourage landowners and operators to operate and maintain the land treatment measures for the protection and improvement of the watershed.
9. The Sponsoring Local Organization will be responsible for the operation and maintenance of the structural works of improvement by actually performing the work or arranging for such work in accordance with agreements to be entered into prior to issuing invitations to bid for construction work.
10. The costs shown in this agreement represent preliminary estimates. In finally determining the costs to be borne by the parties hereto, the actual costs incurred in the installation of works of improvement will be used.
11. This agreement is not a fund obligating document. Financial and other assistance to be furnished by the Service in carrying out the watershed work plan is contingent on the availability of appropriations for this purpose.

A separate agreement will be entered into between the Service and the Sponsoring Local Organization before either party initiates work involving funds of the other party. Such agreements will set forth in detail the financial and working arrangements and other conditions that are applicable to the specific works of improvement.

12. The watershed work plan may be amended or revised, and this agreement may be modified or terminated only by mutual agreement of the parties hereto except for cause. The Service may terminate financial and other assistance in whole, or in part, at any time whenever it is determined that the Sponsoring Local Organization has failed to comply with the conditions of this agreement. The Service shall promptly notify the Sponsoring Local Organization in writing of the determination and the reasons for the termination, together with the effective date. Payments made to the Sponsoring Local Organization or recoveries by the Service under projects terminated for cause shall be in accord with the legal rights and liabilities of the parties.

An amendment to incorporate changes affecting one specific structural measure may be made by mutual agreement between the Service and the sponsor(s) having specific responsibilities for the particular structural measure involved.

13. No member of or delegate to congress, or resident commissioner, shall be admitted to any share or part of this agreement, or to any benefit that may arise therefrom; but this provision shall not be construed to extend to this agreement if made with a corporation for its general benefit.
14. The program conducted will be in compliance with all requirements respecting nondiscrimination as contained in the Civil Rights Act of 1964, as amended, and the regulations of the Secretary of Agriculture (7 C.F.R. 15.1-12), which provide that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be otherwise subjected to discrimination under any activity receiving federal financial assistance.
15. This agreement will not become effective until the Service has issued a notification of approval and authorizes assistance.

Escambia County Soil and Water
Conservation District

Local Organization

By Allen W. Moye

Title Chr.

Address Flomaton Ala. Rt. 1

Zip Code

Date 5-28-75

The signing of this agreement was authorized by a resolution of the governing body of the Escambia County Soil and Water Conservation District adopted at a meeting held on 5-28-75.

Mooney North
Secretary, Local Organization

Address Brewton Ala

Date 5-28-75

Escambia County Commission

Local Organization

By Robert O. Owens

Title Chairman County Commission

Address Brewton, Ala. 36426

Zip Code

Date 6-9-75

The signing of this agreement was authorized by a resolution of the governing body of the Escambia County Commission adopted at a meeting held on June 9, 1975.

Kenneth Taylor
Secretary, Local Organization

Address Brewton, Ala

Date June 9, 1975

City of Atmore

Local Organization

By

Chris E. Davis

Title

Mayor

Address

Atmore, Ala. 36502

Zip Code

Date

June 2, 1975

The signing of this agreement was authorized by a resolution of the governing body of the City of Atmore adopted at a meeting held on

June 2, 1975.

Louise W. Day

Secretary, Local Organization

Address

Atmore, Ala.

Date

6/2/75

Appropriate and careful consideration has been given to the environmental statement prepared for this project and to the environmental aspects thereof.

Soil Conservation Service

United States Department of Agriculture

By

W. B. Lingle

State Conservationist

Date

6/10/75

SUMMARY OF PLAN

Upper Brushy Creek Watershed covers an area of about 10,980 acres in southwest Escambia County, Alabama. Sponsoring local organizations are Escambia County Soil and Water Conservation District, Escambia County Commission, and the City of Atmore.

The topography of the watershed, especially in the area where structural measures are planned, is nearly level with an undefined flood plain. This portion is highly agricultural with most of the land being used for soybean production. The lower portion of the watershed (west of County Road No. 1) has more forest cover, see Figure 2. This area has steeper slopes than the upper portion and also has a more defined flood plain.

East of the St. Louis-San Francisco Railroad, inadequate channel capacities cause a serious flooding and drainage problem. Portions of crops are lost and yields are reduced each year as a result of flooding and poor drainage. West of the railroad, steeper slopes and soil conditions contribute to an erosion problem.

Proposed structural measures consist of approximately 7.2 miles of channel work. Channel work will consist of earth excavation to enlarge present channels and provide a more efficient and unrestricted streamflow. Existing channels are small and/or ineffective and are poorly defined. Streamflow within these 7.2 miles consist of 3.55 miles of ponded water, 2.75 miles of ephemeral and 0.90 miles of intermittent. A grade stabilization structure will also be installed to avoid excessive velocities. Conservation land treatment measures are planned to be applied on cropland and pastureland throughout the watershed. Forestry measures include six man-months of technical assistance for forest management plan development, marketing assistance, and assistance to the fire prevention program. Thirty man-months of a local fire prevention contractor will be used to alleviate the fire problem through on-the-ground contacts with landowners and forest users during the fire season (November to April) throughout the installation period.

The project will be installed within a 5-year installation period at a total estimated cost of \$657,100, of which \$162,200 is for land treatment and \$494,900 is for channel work. This cost will be shared between P. L. 566 and other funds as follows:

<u>ITEM</u>	<u>P. L 566</u>	<u>OTHER</u>	<u>TOTAL</u>
Conservation Land Treatment	\$ 38,900	\$123,300	\$162,200
Channel Work	392,300	102,600	494,900
TOTAL	\$431,200	\$225,900	\$657,100

The Escambia County Commission will be responsible for the local share of construction cost under a "Performance of Work" arrangement and will also be responsible for maintaining the channel. The City of Atmore and the County Commission will be responsible for providing all necessary land rights. An operation and maintenance agreement between the Escambia County Commission and the Soil Conservation Service (SCS) will be initiated prior to project installation. This agreement will set forth operation and maintenance responsibilities of each organization. The estimated average annual operation and maintenance cost is \$2,200. Total average annual costs of the project are estimated to be \$31,400 and total average annual benefits are estimated to be \$67,400. This results in a benefit-cost ratio of 2.1:1.0.

The project will reduce erosion rates to within the allowable soil-loss tolerance levels resulting in a 32-percent reduction in sediment yield at the watershed outlet. The forest fire hazard will be reduced. Agricultural flood damages will be reduced by 77 percent and drainage outlets will be made available. The project will also reduce urban floodwater damages. The project will increase the real estate tax base, create employment, and improve the local economy within the area. Installation of the project will require the clearing of about 75 acres of forest land.

WATERSHED RESOURCES-ENVIRONMENTAL SETTING

Physical Resources

Physical Data

Upper Brushy Creek Watershed has a drainage area of 10,980 acres. It is situated near the southwest Alabama City of Atmore (population 8,300), in Escambia County. A portion of Atmore is located within the watershed, (see figure 1). The watershed is located in the South Atlantic Gulf Water Resource Region and the St. Josephs-Perdido subregion. Brushy Creek flows in a southerly direction and empties into the Perdido River about 17 miles south of Atmore. The watershed is located about 50 miles northeast of Mobile, Alabama (population 190,000). About 4,200 people reside within the watershed boundary with about 95 percent being urban residents of Atmore.

The "major" soil and water resource problems exist in a drainage area of 3,580 acres located east of the St. Louis-San Francisco Railroad and immediately northeast of (and including part of) the City of Atmore. This area is relatively flat, has poor surface drainage, and is heavily row cropped. Stream channels are either small or non-existent. There are frequent floodwater and drainage problems because of the nearly level topography, lack of outlets, and insufficient stream channel capacities. Residents of Atmore suffer frequent floodwater damages and poor storm sewer drainage. About 1,970 acres is damaged by flooding and inadequate drainage.

The City of Atmore has adopted land use regulations that will control future developments in the flood plain areas within the city limits. These regulations were adopted on December 23, 1974 and are in accordance with standards of the National Flood Insurance Act of 1968.

In other areas of the watershed, especially on the steeper crop fields west of the St. Louis-San Francisco Railroad, erosion is of primary concern. Average annual erosion rates on these lands exceed the maximum soil-loss tolerance established by the SCS.

Soils and Land Capabilities (See figure 3)

Major soils on the uplands are in capability classes and subclass I, IIe, and IIIe. The predominant well and moderately well drained soils are in the Benndale, Grasmere, Greenville, Bowie, Orangeburg, Poarch, Ruston, and Tifton series. Moderately to poorly drained soils are

mainly sandy loams and silt loams in capability classes and subclass IIw, IIIw, IVw, and Vw. Included soil series are Atmore, Bibb, Escambia, Freemanville, Grady, Irvington, and Robertsdale.

The following is a brief series description of the aforementioned soils:

- (1) Benndale The Benndale series consists of deep, well-drained soils of the uplands formed in thick beds of sandy loam. Typically, the surface layer is dark grayish brown fine sandy loam underlain by yellowish brown loam or fine sandy loam to a depth of about 68 inches, grading into shades of red, gray, and brown mottles. Slopes are 0 to 2 percent.
- (2) Grasmere - Grasmere series comprises dark surfaced, well drained, clayey soils with dark red subsoils. These soils occur in slight depressions or along small upland drainageways with gradients of less than 3 percent.
- (3) Greenville - The Greenville series consists of well drained, friable, moderately permeable upland soils. These soils have a dark reddish brown fine sandy loam surface layer over a dark red sandy clay to clay subsoil. Regolith is clayey marine sediments high in sand. Slopes range from 0 to 5 percent.
- (4) Bowie - The Bowie series consists of deep moderately well drained loamy upland soils with plinthite. These soils have moderately slowly permeable lower subsoils containing plinthite which perches water for short periods each year. Slopes range from 0 to 5 percent.
- (5) Orangeburg - The Orangeburg series consists of deep, well drained soils on undulating to rolling uplands of the Coastal Plain. Typically, the surface layer is dark grayish brown loamy sand about 7 inches thick. The subsoil is mainly yellowish red, friable, sandy clay loam, which extends to 64 inches or more. Slopes range from 0 to 8 percent. Gentle slopes are generally cultivated and steeper ones are wooded.
- (6) Poarch - The Poarch series consists of well drained or moderately drained, moderately coarse textured, upland soils with plinthite in the subsoils. The soils are on loamy marine deposits and occur in broad flats with gradients of less than 5 percent.
- (7) Ruston - The Ruston is a well drained, moderately permeable, acid, upland soil. It has a brown fine sandy loam surface and a red or yellowish red sandy clay loam subsoil. This soil developed from marine or alluvial sediments. It occurs on Pleistocene age or older areas of the Coastal Plain. Slopes range from 1 to 8 percent.

(8) Tifton - The Tifton series consists of well drained, level to sloping, pebbly soils. Typically, the surface layer is a very dark grayish brown loamy sand. The subsoil is mainly yellowish brown sandy clay loam but is mottled with red in the lower part. Hard iron concretions are in the upper 30 inches of the soil profile, but soft to firm brown concretions are in the lower part. Tifton soils are strongly acid. Slopes range from nearly level to about 8 percent.

(9) Atmore - The Atmore series consists of poorly drained, loamy upland soils with fragipans. These soils are on sandy or loamy marine deposits and occur in broad flats with gradients of less than 5 percent.

(10) Bibb - The Bibb series consists of poorly drained, level to nearly level flood plain soils subject to frequent overflow. They have brownish to grayish sandy loam surface layers over gray stratified sandy and silty subsurface layers. The water table is within 8 inches of the surface from 6 to 11 months each year.

(11) Escambia - The Escambia series consists of somewhat poorly drained, loamy, upland soils with compacted lower subsoils. These soils are on thick marine deposits and occur in broad flats with gradients of 0 to 8 percent.

(12) Freemanville - This is a well drained, friable, moderately permeable, level to gently sloping upland soil. It has a dark grayish brown fine sandy loam surface over a red clay loam or clay subsoil. Hard iron concretions occur throughout the profile. The lower subsoil contains over 5 percent soft plinthite. The regolith is loamy and clayey marine sediments. Slopes range from 0 to 12 percent.

(13) Grady - The Grady series consists of wet soils that occur mainly in small or medium sized circular or oblong depressions on smooth landscapes. Unless drained, these soils are ponded for a greater part of the year. Typically, the surface layer is black sandy loam to clay loam. The subsoil is gray clay mottle with brownish yellow, red and strong brown, and extends to 60 inches or more.

(14) Irvington - The Irvington series consists of moderately well drained soils on nearly level uplands. Typically, these soils have a grayish brown fine sandy loam surface layer. The subsoil is brownish yellow sandy clay loam. A fragipan is at depths of 25 to 30 inches. Hard iron concretions are on the surface and in the subsoil. Slopes are less than 8 percent.

(15) Robertsdale - The Robertsdale series consists of somewhat poorly drained soils on nearly level and slight depressional areas. A fragipan occurs at about 20 inches and hard iron concretions are throughout the profile. The subsoil has from 5 to 30 percent plinthite. Slopes are from 0 to 2 percent.

The capability classes and subclasses are described as follows:

- (1) Class I soils have few limitations that restrict their use.
- (2) Class II soils have some limitations that restrict the choice of plants or that require moderate conservation practices.
- (3) Class III soils have severe limitations that restrict the choice of plants, or require special conservation practices, or both.
- (4) Class IV soils have very severe limitations that restrict the choice of plants, or that require very careful management, or both.
- (5) Class V soils have little or no erosion hazard but have other limitations, impractical to remove, that confine their use largely to pasture, range, forest, or wildlife food and cover.
- (6) Subclass "e" soils are limited in use because of an erosion hazard.
- (7) Subclass "w" soils are limited in use because of wetness or drainage problems.

Geology and Topography 1/

Formations of Tertiary age are included in the general geologic setting. These formations are divided into four series which are in ascending order: The Eocene, Oligocene, Miocene, and the Pliocene. Recent deposits of Quaternary age are found as terrace and alluvial deposits along the rivers and streams of the area. The Tertiary Formations are underlain by rocks of Cretaceous age. The watershed is underlain by the Citronelle Formation of Pliocene age. The Citronelle dips southwestward at 5 to 8 feet per mile and is as much as 135 feet thick at Atmore. It unconformably overlies the undifferentiated deposits of Miocene age.

Upper Brushy Creek watershed lies within the Coastal Plain Physiographic Province and the Southern Pine Hills subdivision of the Province. A prominent physiographic feature in the Southern Pine Hills is the upland plain developed on the Citronelle Formation. It is characterized in this area by broad flat, table-like surfaces, in places 5 to 10 miles wide. A prominent physical feature of the uplands is the numerous, small round, or elongated depressions which occur in the interstream areas. These depressions vary from a few feet to about 100 feet in diameter. The upland plain has an altitude of about 345 feet mean sea level (MSL). Locally, the relief of the plain varies from about 5 to 15 feet.

Climate

Upper Brushy Creek Watershed has a temperate to subtropical mild humid climate. Extremes in temperature are rare and of short duration. Precipitation is distributed fairly evenly throughout the year. 1/

Average annual rainfall is 60.64 inches. July is the wettest month with a mean precipitation of 7.79 inches; the driest month is October with a mean precipitation of 2.38 inches. The average growing season is approximately 250 days, with the last killing frost occurring in March and the first in November. The mean annual temperature is 66.0 degrees, with the monthly averages ranging from 51.7 in December and January to 82.7 in August. 2/

Mineral and Ground Water Resources 1/

Sand and gravel as a mineral resource occurs in recent alluvial deposits along the major streams and their larger tributaries throughout Escambia County. These deposits have been mapped by the Geological Survey of Alabama in the lower portion of the watershed.

Permeable beds of sand in the Pliocene series in southwestern Escambia County yield moderate to large quantities of water. In Upper Brushy Creek Watershed, the Citronelle Formation is the principal aquifer. Wells tapping sand beds in the Citronelle at depths greater than 65 feet are the principal source of municipal, industrial, and domestic water supplies. Wells less than 65 feet deep generally tap aquifers that are controlled by water table conditions and the water levels fluctuate in response to precipitation and could possibly go dry during periods of prolonged drought. A municipal well at Atmore taps sand beds in the underlying Miocene series at depths of 208 to 261 feet. The well produced 463 gallons per minute in 1957.

Land Use (see figure 2)

Land use in the watershed is as follows:

	<u>Acres</u>	<u>Percent</u>
Cropland	5,600	51
Pastureland	880	8
Forest land	3,130	28
Urban land	870	8
Miscellaneous & Idle land	<u>500</u>	<u>5</u>
TOTAL	10,980	100

Land use in the area subject to flooding and impaired drainage is as follows:

	<u>Acres</u>	<u>Percent</u>
Cropland	850	43
Pastureland	135	7
Forest land	390	20
Urban land	430	22
Miscellaneous & Idle land	<u>165</u>	<u>8</u>
TOTAL	1,970	100

Soybeans is the major crop produced in the watershed. Soils and climate are especially adapted to soybean production and markets are plentiful.

The predominant pasture grass is bahia. Most pastures are scattered and in small acreages.

There are about 3,130 acres of forest land in the watershed. The major forest type is longleaf pine, followed by sweet gum-yellow poplar, loblolly pine, and pond cypress. The majority of the forest land is in the lower portion of the watershed. The only forest resource east of the St. Louis-San Francisco Railroad is along streams and in small depressed areas with little or no natural drainage. The dominant forest type is sweet gum-yellow poplar.

Approximately 1,970 acres (55 percent) of the drainage area served by channel work is mapped as having a wetness limiting factor for agricultural production. This area will be benefited by the planned channel work, see figure 1.

Surface Water Resources

Brushy Creek originates approximately two miles northeast of Atmore and flows in a southwesterly direction to the east city limit of Atmore, thence westerly along the northern edge of Atmore for about four miles, thence southwesterly 1.5 miles to U. S. Highway 31, and thence southerly approximately 17 miles to its confluence with the Perdido River.

There are no large man-made impoundments in the watershed, and only two farm ponds with the larger having a surface area of eight acres. Around the upper perimeter of the watershed there are areas of ponded water with no noticeable flows because of lack of outlets or due to the high water table. These natural ponds, known as "Grady ponds" due to the existence of the Grady soil series, range in size from about 0.5 to 20 acres; the deeper ponds are 3 to 4 feet deep. Most of them are dry during late summer and fall.

Landowners have attempted to drain ponded areas above station 69+80 on Brushy creek main by excavating channels in the vicinity of planned lateral 7, and along Brushy Creek from station 55+40 to station 112+00 (see figure 1). This channel work has not functioned properly because of the inadequate outlets.

In the vicinity of Atmore, there is no stream channel though there is a more defined drainage pattern with flow during periods of surface runoff. Downstream from Escambia County Road No. 1, the stream is perennial with a defined, natural channel.

There are no stream gage records for Upper Brushy Creek Watershed. Streamflow records are available for Brushy Creek at a U.S. Geological Survey partial-record station (Station 02376270) which is 2-1/2 miles southwest of Atmore and approximately 1-1/2 miles below the lower extremity of the watershed project. Based on streamflow records for 1946-63, the estimated 10-year 7-day low flow is 5.4 cfs (cubic feet per second) and the estimated median annual 7-day low flow is 10 cfs for a drainage area of 20 square miles at this station.

A water sample collected on November 20, 1963, from Brushy Creek (Station 02376270) had a pH of 7.5, a calcium-magnesium hardness of 10 mg/l (milligrams per liter), a noncarbonate hardness of 2 mg/l, and contained 4.0 mg/l chloride and 10 mg/l bicarbonate. 3/

Field investigations revealed that the upper portions of the creek are heavily polluted at several locations because of garbage dumping. These dumps are within the city limits of Atmore and consist of materials ranging from cans, mattresses, and old washing machines, to dead animals, and other organic wastes. Pollution from urban runoff is also very evident.

There are five natural, wooded shallow ponds in the drainage area served by channel work. These natural "Grady ponds", range in size from two acres to nine acres. These wetlands are type - 7 wooded swamps as described in "Wetlands of the United States". 4/

Dominant trees in these ponds include water oak, overcup oak, tupelo gum, swamp blackgum, and pond cypress. Duckweeds, smartweeds, and other aquatic plants important to waterfowl are often found in these areas. Waterfowl use of the natural ponds on the project area is low due to the small area involved and the location of these ponds near developed urban areas. These ponded areas will not be affected by the project.

Present and Projected Population

In 1970, the population of Escambia County was 34,906. The projected populations for the years 1990 and 2020 are 43,600 and 60,800, respectively. 5/ Historic and projected populations of the St. Josephs-Perdido Water Resource Subregion are as follows: 6/

<u>Year</u>	<u>Population</u>
1969	709,848
1990	840,200
2020	1,116,600

In 1970, the population of the City of Atmore was 8,300. Population projections are not available for Atmore, however, it's population is expected to increase at about the same rate as the county.

Economic Resources

All land in the watershed is privately owned except for 297 acres owned by the City of Atmore. The 297 acres is located in the lower portion of the watershed. This area is planned for industrial or municipal development. In addition, the City of Atmore owns 84 acres within the city limits which includes a 9 acre city park. A private company, manufacturing paper products, owns about 1,440 acres in the watershed.

Future urban development in flood prone areas in the City of Atmore will be governed by resolutions adopted by the City Council of the City of Atmore in December 1974; Resolution 224-B states in part 1. "The City Council of Atmore, Alabama, assures the Federal Insurance Administration that it will enact as necessary, and maintain in force for those areas having flood hazards, adequate land use and control measures with effective enforcement provisions consistent with the Criteria set forth in Section 1910 of the National Flood Insurance Program Regulations."

Resolution 225-B states that the city is enforcing Southern Standard Building Code of 1969 with 1972 supplements. The code prohibits building, improving, repairing, moving, or demolishing any structure without a building permit from the Building Inspector.

The Building Inspector shall review all building permit applications for new construction or substantial improvements to determine whether proposed building sites will be reasonably safe from flooding.

Additionally, the Building Inspector shall review subdivision proposals and other proposed new developments to assure that all such proposals are consistent with the need to minimize flood damage.

The major farm enterprise within the watershed is the small family farm. SCS field office records show there are 104 farms in the watershed averaging about 83 acres per farm. Sixty of these farms, averaging 41 acres per farm, are in the drainage area served by the planned channel work. Soybeans is the major crop produced in this area and present yields average about 24-26 bushels per acre. In other portions of the watershed the average yield is about 30-32 bushels per acre.

Basically, forest lands in the watershed are in a good silvicultural condition. Basal area ranges from 90 to 160 square feet per acre, indicating many of the forest stands are overstocked. Site index* ranges from 90 to 110 feet. These forest lands will grow from 400 to 500 board feet per acre per year.

Forest land values in the watershed range from \$150 to \$250 per acre, plus stumpage value of timber on the land. The higher valued lands are found closer to the City of Atmore. Present prices for good pine sawtimber in the area average \$100 per thousand board feet with pulpwood \$7.50 per cord. Stocking averages about 5,000 board feet in good sawtimber and 15 to 20 cords per acre in pulpwood. Hardwood pulpwood averages \$2.50 per cord with average stocking about 12 to 15 cords per acre. Very little hardwood sawtimber exists in the watershed.

The value of agricultural land in the watershed ranges from \$700 to \$1,000 per acre. Urban residential property ranges in value from \$4,000 to \$8,000 per acre.

Various local markets are readily accessible to agricultural producers. Adequate transportation routes to the area are provided by Escambia County Roads 1 and 27, State Highway 21, U. S. Highway 31, Interstate Highway 65, and the St. Louis and San Francisco and the Louisville and Nashville Railroads.

The economy of the watershed is almost entirely dependent upon agriculture. Soybean production is the major source of agricultural income. According to the 1969 census, about 46 percent of Escambia County farmers had gross sales of less than \$2,500 compared to 64 percent in 1964 7/

The inhabitants of the watershed are primarily low income persons living under economically depressed conditions. Many attempt to supplement their incomes by farming small acreages.

* The height of a tree at 50 years.

Escambia County, as of October 1973, had a total work force of 13,870 with an unemployment rate of 4.1 percent. ^{8/} The leading sources of non-agricultural employment are as follows:

<u>Non-Agricultural Industries</u>	<u>Employment</u>
Textiles and Apparel	1,860
Wholesale and Retail Trade	1,840
Government	1,680
Services	1,070
Lumber and Wood Products	950

Plant Resources

There are 2,570 acres of forest land in the western portion (west of county road #1) of the watershed. This portion is composed of the following forest types, in order of predominance: longleaf pine (Pinus palustris), sweet gum (Liquidambar styraciflua), yellow poplar (Liriodendron tulipifera), loblolly pine (Pinus taeda), loblolly pine - hardwood, and pond cypress (Taxodium ascendens).

There are 560 acres of forest land in the eastern portion of the watershed consisting of five forest types: sweet gum-yellow poplar, loblolly pine, cypress, slash pine, and pine-hardwood. Sweet gum-yellow poplar is the dominant type followed closely by loblolly pine and cypress. The remaining forest resource is found along streams and in small depressed areas with little or no natural drainage.

There is high diversity of woody species in both the overstory and understory. A study of small stream bottoms in the coastal plain of southwestern Alabama by Gemborys and Hodgkins ^{9/} indicates that 65 woody species were encountered in their plots. They observed 27 species in the overstory and 62 species in the understory. *

Some of the most common substratum species include dogwood (Cornus florida), waxmyrtle (Myrica cerifera), oak (Quercus spp.), sweetgum, and gall berry (Ilex glabra).

Grasses and forbs are abundant on the pine sites. They are much less abundant on hardwood sites unless woodland harvest has thinned the stand and reduced canopy cover. A study of potential understory forage in

* Understory is defined as less than 1.5 inches diameter breast high, but greater than 1 foot tall.

woodlands in the coastal plain of Alabama has been made by the Soil Conservation Service. Principal species commonly found in the pine forest of the uplands include: pinehill bluestem (Andropogon divergens), little bluestem (A. scoparius), broomsedge (A. virginicus), three awns (Aristida spp.), plumegrass (Erianthus alopecuroides), grass leaf gold aster (Chrysopsis graminifolia), tickclovers (Desmodium spp.), and low panicums (Panicum spp.). Principal species of the wetter hardwood sites include: low panicums, sedges (Cyperus spp.), rushes (Juncus spp., Scirpus spp.), longleaf uniola (Uniola sessiliflora), and switchcane (Panicum sp.).

The Grady ponds are dominated by tupelo (Nyssa sp.), sweetbay magnolia (Magnolia virginiana), pond cypress, sedges, rushes, and other aquatic plants. The improved pastures are almost entirely Pensacola and Argentine bahiagrass (Paspalum notatum). Some native and naturalized plants always invade the stands, the most common invaders include: dog fennel (Eupatorium capillifolium), common bermudagrass (Cynodon dactylon), carpetgrass (Axonopus affinis), little barley (Hordeum pusillum), and broomsedge. Sedges, rushes, and curley dock (Rumex crispus) are also common on wet soils. Reseeding annual clovers (Trifolium spp.) are often overseeded by the farmers to improve forage quality and extend the grazing period.

The plant communities in the croplands of the watershed are almost stable systems. The farmers desire to maintain single crop systems in the cultivated row crop fields. They use cultural, mechanical, and chemical methods to curtail the invasion of weeds, but even the most successful operations fail to control all undesirables. The diversity and number of individual species of weeds that invade crops are determined by both natural and cultural factors such as site selection, weather conditions, previous land use, timeliness of operations, and effectiveness and selectivity of chemical herbicides.

Soybeans (Glycin max) is the most extensively grown row crop in the watershed. Weeds that commonly invade soybeans include crabgrass (Digitaria sanguinalis), coffeeweed (Cassia obpusifolia), pigweed (Amaranthus spinosus, A. retroflexus), cocklebur (Xanthium pennsylvanicum), barnyardgrass (Echinochloa crusgalli), and Johnsongrass (Sorghum halepense).

Weedy plants that are common in corn (Zea mays) include crabgrass, Johnsongrass, cocklebur, and coffeeweed.

Weeds common in cotton (Gossypium hirstum) and garden and truck crops include all of those common in soybean fields plus nutgrass (Cyperus spp.) and prickley sida (Sida spinosa).

Wheat (Triticum aestivum) does not have serious weed problems except in fields that become infested with wild mustard (Brassica spp.).

Fish and Wildlife Resources

A field study of the animal resources in the Upper Brushy Creek Watershed was conducted in January, 1974, by representatives of the Alabama Department of Conservation and Natural Resources, the U. S. Fish and Wildlife Service, and the Soil Conservation Service. The study consisted of a one day field trip in which the group observed the watershed and discussed the value of the fish and wildlife resources in the area to be affected by channel work. Information on the existing animal life was drawn from outside sources.

Stream game fishery values are of low quality or non-existent within the watershed area. This low quality in game fishery is the result of the following conditions:

1. A portion of the stream has ephemeral or intermittent flow.
2. Pollution from urban drainage and trash dumping have created an unsuitable habitat for game fish species.
3. The general nature of the stream and its immediate surroundings, especially within the city limits of Atmore, causes the area to be undesirable for game fishery purposes.

None of the rare and endangered fish species listed by the Alabama Department of Conservation and Natural Resources are known to occur in the watershed area. 10/

Game wildlife resources consist of eastern cottontail rabbit (Sylvilagus floridanus), bobwhite quail (Colinus virginianus), mourning dove (Zenaidura macroura), gray squirrel (Sciurus carolinensis), raccoon (Procyon lotor), opossum (Dicelphis marsupialis), and some waterfowl. Most often hunted species of the area are squirrel, rabbit, and quail. The lack of suitable bottom land hardwood limits the habitat of the gray squirrel as well as the raccoon. Quail and dove populations are dependent on the type of crops grown. Wild turkeys (Meleagris gallopavo silvestris) are not known to occur, and white-tailed deer (Odocoileus virginianus), if present, occur in numbers too low to support appreciable hunting pressure. Both turkey and deer habitats are severely limited by the lack of suitable bottom land hardwoods. According to Dr. J. L. Dusi, Professor of Zoology Entomology at Auburn University in Alabama, there are no rare and endangered mammals that would be affected by the project. 11/

Garbage dumps located on the upper portion of Brushy Creek provide food for such scavengers as opossum, raccoon, fox, and rats. Use of these unsanitary dumps by scavengers could be harmful in terms of disease carrying capabilities.

The Alabama Department of Conservation and Natural Resources uses the following definitions to describe the rare and endangered species in Alabama. 11/

1. Rare - 1: The definition for "rare - 1" is same as that used by the Bureau of Sport Fisheries and Wildlife, and is defined as: "a rare species or subspecies is one that, although not presently threatened with extinction, is in such small numbers that it may be endangered if its environment worsens."
2. Rare - 2: "a species or subspecies that may be quite abundant where it does occur but is known in only a few localities or in a restricted habitat within Alabama."
3. Endangered: "any species or subspecies occurring in Alabama threatened with extinction" by any means.
4. Status undetermined: "a species or subspecies that has been suggested as possible rare or endangered but about which there is not information to determine its status. More information is needed."

The Alabama Department of Conservation and Natural Resources lists the following reptiles and amphibians as rare and endangered species whose ranges overlap or approach Escambia County. Personal communication with Dr. Robert Mount, Professor of Zoology - Etymology at Auburn University in Alabama, provided additional detailed information on the individual species.

Rare and Endangered Reptiles and Amphibians:

1. Dusky Gopher Frog Rana areolata sevosa (Goin and Netting)
The status of the Dusky Gopher Frog is rare - 1, its range being the Gulf Coastal Plain. According to Dr. Mount it is "doubtful" that the Dusky Gopher Frog occurs in the area affected.
2. Flatwoods Salamander Ambystoma cingulatum (Cope)
Status of the Flatwoods Salamander is rare - 1, and one of the rarest salamanders in Alabama. According to Dr. Mount, it is "highly probable" that this species occurs in the affected area although it has not been reported. Dr. Mount further

stated that the "breeding sites are usually cypress ponds and that the preferred habitat is along swamp margins of small streams". Alteration of the natural waterways and wetland drainage constitutes a direct threat to the survival of this species

3. River Frog Rana hecksheri (Wright)
R. hecksheri has a status of rare - 2. The area to be affected does not include any River Frog habitat, therefore, the species will not be affected by this project. The Alabama Department of Conservation and Natural Resources states that stream channelization is a potential threat to the species 10/, however, since this project does not drain any natural wetlands such as cypress ponds, no effect on this species is probable.
4. Florida Pine Snake Pituophis melanoleucus mugitis (Barbour)
This snake is presently placed in the "endangered" category and is rapidly declining in numbers. The snake has been known to occur in the area, however, Dr. Mount states that any effect on the species would be "inconsequential" to channel work mainly because it is not dependent on flowing streams.
5. Rainbow Snake Farancia erythrogramma (Palisot de Beauvois). The status of the Rainbow Snake is undetermined, however, Dr. Mount states that there is "low probability that the species is in the area affected" due to unsuitable habitat. The Rainbow Snake inhabits streams and relies on the eel as a major food source. Dams could prevent the upstream migration of young eels and thus adversely affect the snake, however, no dams will be installed in this project. The alteration of the stream itself could destroy some Rainbow Snake habitat.

Recreational Resources

The Atmore city park on North Eighth Avenue covers about 19 acres and offers recreational activities in the form of swimming, picnicking, and field sports. A portion of the park is fund-assisted by the Bureau of Outdoor Recreation through the U. S. Land and Water Conservation Fund for providing recreational facilities. The park provides a pool, two basketball courts, a tennis court, play fields, group shelters, and picnic tables. It is open to the general public and is the primary source of recreational activity of this type for watershed inhabitants. The potential for recreational participation will increase if the flood hazard is reduced.

In addition, about 75 acres of the city's forest land is already under management directed toward future recreational development.

There are no potential recreational water impoundment sites existing within the watershed. 12/

Brushy Creek has been classified as having a potential for a fish and wildlife resource. 13/ This potential is located primarily below the Upper Brushy Creek Watershed boundary. The fishery resource of Brushy Creek within the watershed is very poor primarily because of the ephemeral or intermittent streamflow.

Archaeological, Historical and Unique Scenic Resources

There are no known historical sites of value existing within the watershed according to the National Register of Historic Places. Also, the Alabama Historical Commission does not list any historical sites or unique scenic areas of value within the watershed.

Recently, the University of Alabama, Department of Anthropology, studies the watershed for possible archaeological or historical sites of importance that might be affected by the proposed project. The results of the study indicate that no such sites exist within the watershed area.

Soil, Water, and Plant Management Status

Land use in the watershed is fairly stable. The area is highly specialized for row crop production, especially soybeans, and has made little change in recent years. The stability in land use is mainly due to the fact that, under present conditions, most of the land is already in agricultural use that has a potential for such use. Much of the land lies idle or is in low producing forests as a result of the flooding and wetness problems.

Conservation land treatment measures are proposed for installation for water management and erosion control. The accelerated land treatment program is already being implemented. The Escambia County Soil and Water Conservation District (S&WCD) is providing technical assistance in applying these land treatment measures.

At present there are 44 cooperators with the Escambia County S&WCD within Upper Brushy Creek Watershed. Conservation farm plans have been

developed with 42 of these cooperators. To date, approximately 62 percent of the watershed, less the urban area, is covered by conservation agreements. About 60 percent of the planned land treatment measures have already been applied.

A study of conservation plans and Soil Conservation Service progress reports on farms in the watershed indicates that considerable progress has been made in the land treatment program. Conservation measures planned and applied from 1968 to 1973 are:

<u>Conservation Measures</u>	<u>Unit</u>	<u>1968 to 1973</u>	
		<u>Planned</u>	<u>Applied</u>
Conservation Cropping System	Ac.	4,105	3,871
Field Border	Ft.	16,465	16,465
Grassed Waterway	Ac.	22	16
Contour Farming	Ac.	584	219
Terracing	Ft.	167,424	104,718
Pasture and Hayland Planting	Ac.	627	203
Pasture and Hayland Management	Ac.	494	143
Drainage Mains and Laterals	Ft.	29,700	19,540
Drainage Field Ditches	Ft.	40,750	16,450
Diversions	Ft.	1,300	1,300
Ponds	No.	3	2
Wildlife Upland Habitat Management	Ac.	57	28

The Escambia County Soil and Water Conservation District is active in promoting conservation measures on agricultural land. The District Supervisors publish a quarterly newsletter informing cooperators of conservation services that are available and activities that have been accomplished.

Conservation plans have been prepared on 5,943 acres in the watershed. Conservation practices have already been applied to the extent that 3,635 acres are adequately treated. This includes 3,485 acres of cropland, 136 acres of pastureland, and 14 acres for wildlife habitat. Over 1,000 additional acres have some of the planned conservation practices applied and are partially treated.

The return of cost sharing assistance through programs administered by the Agricultural Stabilization and Conservation Service - Rural Environmental Conservation Program (RECP) and Rural Environmental Assistance Program (REAP) - will stimulate increased application of planned conservation measures.

Outside the industrial ownership, the forest land is in a relatively unmanaged condition. The individual forest stands are small and scattered, making management difficult and expensive. On the basis of economic returns, forestry cannot compete with row crops. These small stands of timber are ignored by the landowners until they are merchantable size and then, they are liquidated. Most of these stands are overstocked with good quality poletimber or sawtimber.

The hardwoods along the flood plain of Brushy Creek have been cut over, leaving low-quality trees as growing stock. The dominant species is water oak. Other overstory species are sweet gum, water tupelo, and bay. These hardwood forests are in a poor silvicultural condition. However, they do provide habitat for non-game species.

Interest in forest management is minimal. Only three forest landowners have forest management plans. These include the two industrial ownerships and the City of Atmore. These forests are well-stocked and receive intensive forest management.

The Alabama Cattlemen's Association is emphasizing better pasture programs as one of its objectives. The current president of the Association lives near the watershed and it is expected that his association with this organization will help stimulate local interest in livestock and forage programs.

REFERENCES CITED

- 1/ Geological Survey of Alabama, Geology and Ground Water Resources of Escambia County, Alabama, Bulletin No. 74, 1963.
- 2/ United States Department of Commerce, National Oceanic and Atmospheric Administration, Climatological Data, Volume 78, No. 13.
- 3/ Geological Survey of Alabama, Seven-Day Low Flows and Flow Duration of Alabama Streams, Bulletin 87, Part A, 1967.
- 4/ U. S. Department of the Interior Fish and Wildlife Service, Wetlands of the United States, Circular 39, 1956.
- 5/ Baseline Projections, Published by the Alabama Development Office, March 1973.
- 6/ OBERS Projections, Volume 3, Water Resources Regions, 1-8, 1972.
- 7/ U. S. Department of Commerce, Bureau of the Census, 1969 Census of Agriculture.
- 8/ Alabama State Employment Service, Labor Market News, November 1973.
- 9/ Gemborys, S. R. and Earl J. Hodgkins, Forests of Small Stream Bottoms in the Coastal Plain of Southwest Alabama, Ecology, Volume 52, No. 1.
- 10/ Rare and Endangered Vertebrates of Alabama, Alabama Department of Conservation and Natural Resources, Department of Game and Fish, June 1972, 92 pp.
- 11/ Personal interview by M. A. Phillippi, Soil Conservation Service, June 26, 1974.
- 12/ U.S.D.A., Soil Conservation Service, Appraisal of Potential for Outdoor Recreational Developments, Escambia County, Alabama.
- 13/ Alabama Water Improvement Commission, Water Use Classifications for Interstate and Intrastate Waters of Alabama, May 5, 1967.

WATER AND RELATED LAND RESOURCE PROBLEMS

Land and Water Management

The 1969 Census of Agriculture shows that 349 of the 740 farms in Escambia County had incomes and sales of less than \$2,500 per year. 1/ The Census shows the average size farm for the county was 165.3 acres. The average size farm in the watershed is about 83 acres. The average size farm in the watershed under conservation plan is 141.5 acres and the average size not under plan is only 43 acres. This indicates that larger landowners are more willing to plan and apply conservation measures.

Landusers with low economic returns are more inclined to use intensive cropping systems that exceed the capabilities of the land. Intensive cropping systems and high rates of erosion are often found on the same soils. 2/ Much of the agricultural land in the watershed is not subject to high erosion rates, however, Soil Conservation Service studies indicate that the average rate of erosion on croplands exceeds acceptable limits for adequately protected land. 3/

Most of the soils in the benefited areas have high subsurface water levels which impede crop yields. This excess water causes additional expense by hindering tillage, planting, and harvesting operations. It also interferes with the normal physiological function of the planted crops to the extent that fertilizers are inadequately utilized and yields are reduced.

Small farms with low yields are not well suited to diversification. Farmers are often restricted to monoculture systems because they have neither the land on which to expand nor the money to purchase additional equipment needed for diversified farming.

The major problem on forest lands is high fire occurrence in the western half of the watershed. Wildfires reduce tree growth, destroy timber and further reduce an already limited, suitable wildlife habitat. During the period 1968 through 1972, an average of 2 percent of the forest land burned annually. Fire occurrence during this period was as follows:

Fire Occurrence-Upper Brushy Creek Watershed
1968 - 1972

Year	Number of Fires	Acres Burned	Percent of Forest land
1968	1	3.2	.10
1969	7	65.0	2.08
1970	10	86.0	2.75
1971	11	92.0	2.94
1972	9	74.0	2.36

The 1,440 acres of forest land owned by forest industry is burned under controlled conditions to prevent fuel buildup, inhibit the growth of hardwood brush, and keep down the spread of brown spot needle disease in the longleaf pine stands. Wildfires throughout the watershed have contributed to a poor hydrologic condition by removing the litter from the soil surface.

Floodwater and Drainage

One thousand nine hundred and seventy acres are damaged by flooding or poor drainage. Damages occur as a result of a combination of floodwater and drainage problems caused by slow movement or no movement at all of excess rainfall from the nearly level land. Land use in the floodwater and drainage problem area is as follows:

Problem Area		Percent
Cropland	850 acres	43
Pastureland	135 acres	7
Forest land	390 acres	20
Misc. or Idle	165 acres	8
Urban	<u>430 acres</u>	<u>22</u>
Total	1,970 acres	100

Small, frequent floods cause the majority of agricultural damages with spring being the season when most damages occur. Periods of soil inundation and saturation just prior to and during crop planting and the presence of wet areas during growing and harvesting seasons increase production costs and decrease yields. The predominant crop produced in the floodwater and drainage problem area is soybeans. Pastures are damaged from frequent and prolonged inundation and soil saturation with the result being a loss in grazing time and an inferior grazing crop.

There are approximately 60 landowners, excluding urban and city owned land, within the flood hazard area. These landowners experience crop damages and reduced incomes each year. Some landowners have attempted to reduce or eliminate their flooding and drainage problems by excavating channels. These channels have not functioned properly because of the lack of adequate outlets.



This crop field is being flooded by a 2-inch rainfall that caused Brushy Creek to overflow. Floodwater "ponds" in crop fields because of inadequate outlets.



Inadequate channel capacities and debris cause overflow from small rainfalls.



Flooding of N. 8th Avenue City Park. These playgrounds are being flooded by a 2-inch rainfall during January 1971.



Flooding of residences, such as this mobile home, causes foundation and lawn damages. Also, inadequate drainage causes septic tank malfunction.

Present, future without project, and future with project yields projected to about the year 2000 are estimated as follows:

Crop	Yield Per Acre		
	Present	Future W/O Project*	Future W/Project**
Soybeans	25 bu.	36 bu.	56 bu.
Cotton	500 lb.	550 lb.	650 lb.
Bahia Pasture	6 AUM***	7.5 AUM	9 AUM

Major soil series in the area include: Atmore, Escambia, Robertsdale, Ruston, Bibb, and Grady. These are level, nearly level or gently sloping, poorly drained soils having slow runoff. They are predominately in capability classes and subclass IIw, IIIw, IVw, and Vw.

There are about 430 acres within the City of Atmore which has a water problem. The problem on the flood plain along Brushy Creek is flooding of the city park on Eighth Avenue and flooding around nine dwellings located in the vicinity of Eighth Avenue and Crow Street. The maximum depth of out-of-bank flooding in this area is about 4 feet. Debris is deposited in the park and around the dwellings. The use of the park is curtailed. Water does not get into any houses but does inundate yards, septic tanks and disposal fields, and damages personal property, etc. The problem in the remaining area is shallow standing water in a developed residential area caused by an inadequate outlet. Water does not cause any significant monetary damages but does create health and nuisance problems.

There is relatively minor damage to roads and bridges due to the small runoff producing areas, limited number of bridges, and slow movement of water. Average annual floodwater damages to crops and pastures are estimated to be \$31,700. Road and bridge damages are estimated to be \$1,000 annually. Indirect damages are estimated to be \$3,700 annually. Urban damages are estimated to be \$2,130 annually, see table 5.

* Assuming future advancement in management and technology.

** Yield is with more intensive farming practices expected after project installation.

*** Animal Unit Month is the amount of grazing that it takes to satisfy the grazing needs of one mature cow for one month.

Erosion Damage

Based on estimates using the Universal Soil-Loss Prediction Equation, 4/ gross erosion rates in tons per acre per year for the watershed under present conditions are as follows:

1. Cropland - 7.03 tons/acre
2. Pastureland - .30 tons/acre
3. Forest land - .15 tons/acre
4. Urban land - .42 tons/acre
5. Idle land - .36 tons/acre
6. Miscellaneous - .71 tons/acre

Gully, roadside, and streambank erosion in the watershed area is insignificant. There are no critical sediment producing areas in the watershed. Scour damages are not a problem.

At present, average gross erosion on the upland cropland is greater than the maximum soil-loss tolerance. Productivity cannot be sustained economically for an indefinite period if the present rate of erosion continues.

Sediment Damage

Field studies revealed that sediment deposition damages were too slight to evaluate. Some sediment accumulation is evident on forest lands in the lower reaches of the watershed, but because of slow deposition, timber growth and the immature alluvial soils are not measureably damaged.

Storm runoff has a high concentration of suspended sediment, especially during periods of land preparation. Sedimentation in field drains and road ditches is caused by a combination of sediment accumulation and vegetation and can be prevented by proper maintenance.

Average annual sediment yield at the mouth of the watershed is an estimated 10,600 tons or an average annual sediment concentration of 284 milligrams per liter. At the mouth of the floodwater and drainage problem area, the average sediment yield is an estimated 4,300 tons per year, or an average sediment concentration of 352 milligrams per liter per year.

Under existing conditions, the sediment concentration level at both the above locations is fairly low, but is outside the range for a good stream fishery. 5/

Municipal and Industrial Water

The City of Atmore obtains its water supply from drilled wells. Ground water of good quality is abundant in the area, and supplies are adequate to handle the projected future population of the area.

Recreation

A recreational problem encountered in the area is prolonged flooding of the North Eighth Avenue City Park. This facility is available to the general public and is highly utilized by watershed occupants. Flooding limits use of the facilities, and causes physical damages to group shelters, parking areas, and playgrounds.

Population is projected to increase in Escambia County as follows: 6/

<u>1970</u>	<u>1980</u>	<u>1990</u>	<u>2000</u>	<u>2010</u>	<u>2020</u>
34,900	39,000	43,600	48,700	54,400	60,800

Historic and projected participation in selected recreational activities in the area is as follows: 7/

<u>Activity</u>	<u>Percentage of Population</u>		
	<u>1967</u>	<u>1980</u>	<u>2000</u>
Swimming	29	35	35
Picnicking	36	43	45
Fishing	25	26	28
Playing games	17	17	17
Camping	6	8	8
Hunting	11	12	15

With an increasing population and an increasing percentage of people participating in recreational activities, it is anticipated that future recreational needs in the area will far exceed the present supply.

Water Quality

Chemicals, fertilizers, and pesticides have an insignificant effect on downstream water quality. There is a corresponding slow movement of water and low transport of materials in solution. Within the city limits of Atmore, just below Eighth Avenue, the small, ineffective channel is used as a dump for garbage and trash including dead animals. This dumping reduces downstream water quality.

Economic and Social

The small family farm is a major source of livelihood. There are 104 farms in the watershed averaging 83 acres per farm. The drainage area served by the planned channel work is composed of 60 farms averaging about 41 acres per farm. These are low income units with many of the operators supplementing their income with off-farm employment.

Approximately 46 percent of all farms in Escambia County have annual gross sales of less than \$2,500. Sixty percent of these are part-time farms. ^{8/} None of the farms in the watershed utilizes as much as one man-year of hired labor annually.

Many of the landowners are farming land that is either too wet for agricultural purposes or has a severe flood hazard. The area is in immediate need of rural development to help the low-income people establish a better standard of living.

The urban portion is composed primarily of low income families with poor housing. Employment opportunities and chance of improvement for these people are low. Health and sanitation facilities are poor in this section of the city.

REFERENCES CITED

- 1/ 1969 Census of Agriculture - Escambia County, Alabama, U. S. Department of Commerce, January 1972.
- 2/ Wischmeier, Walter H. and Dwight D. Smith, Predicting Rainfall-Erosion Losses from Cropland East of the Rocky Mountains, Agricultural Handbook No. 282, USDA Agricultural Research Service, Washington, D. C. 1965.
- 3/ "Hydrologic Group K & T Factors", USDA-SCS, Fort Worth, Texas, August 1, 1969.
- 4/ U. S. Department of Agriculture, Soil Conservation Service, Procedure for Computing Sheet and Rill Erosion on Project Areas, Technical Release No. 51, September 1972.
- 5/ European Inland Fisheries Advisory Commission as cited in the Practice of Water Pollution Biology, U. S. Department of Interior, Federal Water Pollution Control Administration, 1969, p. 33.
- 6/ Alabama Development Office, Alabama Development News, Standard Population Projections Compiled for Planning and Development Activities, March 1973.
- 7/ Auburn University, Department of Agricultural Economics and Rural Sociology, Participation in Outdoor Recreation in Alabama, October 1970.
- 8/ U. S. Department of Commerce, Bureau of the Census, County and City Data Book, 1972.

PROJECTS OF OTHER AGENCIES

There are no water resource development projects in the area that will either affect or be affected by this project.

PROJECT FORMULATION

The sponsors of the Upper Brushy Creek Watershed Project made application to the State Soil and Water Conservation Committee for watershed planning assistance by letter dated December 20, 1965. Approval with high priority was granted by the committee in August 1970. Preliminary watershed investigations commenced in February 1971.

A field examination was held April 20, 1971, to study the proposed project and its possible effects on the environment. Those attending were representatives of the: U. S. Fish and Wildlife Service, Alabama Department of Conservation and Natural Resources, Sponsoring local organizations, and Soil Conservation Service.

A preliminary investigation was completed in May 1971 and was discussed at a public meeting held at the city hall of Atmore on June 10, 1971. The proposed project was discussed at this meeting and "Preliminary" benefits and costs were presented. Those in attendance were: representatives of the Alabama Department of Conservation and Natural Resources, representatives of the Soil Conservation Service, local sponsors, and interested individuals. Concerned agencies were contacted and prior notice served in local newspapers before all public meetings.

Application for detail planning assistance was made to the Administrator of the Soil Conservation Service on June 23, 1971. Authorization was granted August 17, 1971, and concerned agencies were informed of detailed planning. A public meeting was held August 29, 1973, to discuss a proposed plan and its associated benefits and costs. The sponsors notified the state conservationist of the Soil Conservation Service on November 13, 1973, that they agreed to the plan as proposed.

After the meeting of August 29, it became necessary to update the costs and benefits associated with the project. This necessitated another public meeting held December 18, 1973. The plan was further discussed and updated benefits and costs were presented. The sponsors concurred with the proposal and the updated costs and benefits. The present plan was then developed.

Objectives

Land treatment goals are to apply conservation practices in such a manner that the soil and water resources may be used as efficiently as possible while preserving and protecting it for future generations. The goals also include the use of conservation practices so that treated land results in improvement of the land resource base, adds to the economy, and improves the natural environment.

Quantitative goals were set that could be accomplished during the installation period with accelerated technical assistance. These goals were established after carefully reviewing the long range Escambia County Soil and Water Conservation District Program, the conservation needs within the watershed, the current rate of land treatment, and the ability and willingness of landowners and operators to apply conservation measures.

Cropland in the watershed is eroding at the average rate of 7.03 tons per acre per year as compared to the maximum allowable loss of about 5 tons per acre per year. Through land treatment, it is planned that a reduction of the present average erosion rate will be such that the erosion on all lands will be within the allowable soil-loss tolerance levels.

Objectives for the forest land are to provide adequate land treatment on all these lands and to reduce the annual burned area from wildfires by 90 percent.

Objectives of the structural measures are floodwater and drainage protection for general farm crops. Goals to be achieved if the desired protection is provided are reduced physical crop damages and more timely and efficient farming operations resulting in increased yields and higher grade products, primarily soybeans.

The primary goals of the project are to preserve, enhance and protect the soil and water resources and provide both rural and urban flood damage reduction and agricultural drainage outlets. Goals of land treatment are to enhance and protect the soil and water resources and remove excess water. Goals of channel work are to reduce floodwater damages and provide drainage outlets on 1,540 acres of agricultural land to a level that will significantly increase farming efficiency and yields. Urban objectives are to improve storm sewer outlets and remove excess ponded water that causes a nuisance problem and unsanitary conditions.

Environmental Considerations

The future condition without project and future condition with channel work floodwater elevations were compared for a distance of approximately one and one-half miles immediately below the lower end of the planned channel work to determine if the channel work would increase the flood stages. This comparison was made for the 100-year, 25-year, 10-year, and 2-year storms and the results indicated a maximum increase in depth of inundation of about 0.1 foot. The flood plain in this area is entirely in forest.

Consideration was given to providing a higher degree of protection through the corporate limits of Atmore than will be provided by the planned channel. This was dismissed due to the large increase in cost of channel work required to receive only a slight increase in benefits.

The planned channel work will necessitate the removal of about 75 acres of bottom land forest composed mostly of sweet gum and yellow poplar. This forest land represents poor quality game habitat. Of this 75 acres, 11 acres is committed to the channel; the remainder can be used for other purposes after project installation.

Alternatives

The considered alternatives to the proposed action in planning for the development, conservation, and productive use of the soil, water, and related resources are:

1. Conservation land treatment only.
2. Conservation land treatment and urban zoning.
3. No project.

A discussion of each alternative follows:

(1) Conservation Land Treatment Only - The proposed conservation land treatment measures, with the exception of the drainage field ditches and drainage mains and laterals, could be installed without the accompaniment of structural measures. These land treatment measures are described under "Works of Improvement to be Installed".

This alternative would reduce the average annual floodwater damages by about \$880. It would have little effect, if any, on reducing the drainage problems. Land treatment measures would, however, protect the soil on the steeper slopes in the lower portion of the watershed. Average annual sediment yield would be reduced by about 33 percent and average annual erosion rates would be reduced as follows:

<u>Erosion Reduction With Land Treatment</u>	
<u>Land Use</u>	<u>Percent Reduction</u>
Cropland	34
Pastureland	33
Forest land	26

Wildlife food and cover would also be improved. Floodwater and drainage damage reduction would not be sufficient for any changed land use or intensified farming practices.

The installation cost is estimated as follows:

Item	PL-566	Other	Total
Conservation Land Treatment Measures	\$35,000	\$95,800	\$130,800

(2) Conservation Land Treatment Measures With Urban Zoning

Conservation land treatment measures, with costs and impacts as previously described, could be installed in conjunction with urban zoning. The City of Atmore could be zoned to regulate future land use in regard to flood-water and drainage problems. This regulation of land use would restrict certain developments from entering flood prone or poorly drained areas.

Urban zoning will have no effect on reducing flooding or drainage damages to urbanized properties that are presently in the area. It will, however, eliminate future damages by restricting development in areas subject to damage. Urban flood damages to present developments are not a serious problem in terms of monetary losses. These damages occur primarily as a nuisance to the community. The estimated total cost of this alternative is \$145,000.

(3) No Project - Under this alternative the ongoing land treatment program would continue but there would be no accelerated land treatment program or structural measures to provide flood protection and drainage outlets.

This alternative would result in a lower priority of technical assistance to watershed landusers in the application of land treatment measures. This would delay the rate at which measures would be applied and delay the effects of the land treatment measures on erosion reduction, flood prevention and conservation of soil, water, plant, and related resources. Without the proposed channel work, drainage problems will continue to get worse as the present channel fills with sediment. On-farm drainage mains and laterals, as a land treatment measure, could not be installed without the project since outlets could not be available.

Agricultural damages in monetary terms would continue to increase as prices for farm products rise. Average annual sediment yield at the mouth of the watershed will be reduced by 3.8 percent.

This alternative will not require any land clearing or channel excavation. All resources would be allowed to remain in their present condition. Estimated net annual benefits of \$36,000 will be foregone.

Conclusions

Land treatment measures proposed by this project are necessary to reduce gross erosion rates to within the maximum allowable soil-loss tolerance level. Also, on-farm drainage mains and laterals are needed to remove excess surface and internal water.

Channel work was selected because this is the only alternative that will provide adequate urban and agricultural flood damage reduction. Channel work also will provide agricultural drainage and serve as an outlet for on-farm drainage systems installed by individual landowners.

WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Measures

Conservation land treatment is a basic element in formulating the watershed program. It is defined as applying management, cultural, and structural practices in such a manner that the land is used within the limits of its capabilities and soil losses from erosion are held to acceptable levels. Land treatment is accomplished primarily through the development and implementation of conservation plans.

Technical assistance will be made available by the Soil Conservation Service (SCS) through the Escambia County Soil and Water Conservation District (S&WCD) and by the Forest Service in cooperation with the Alabama Forestry Commission. Technical assistance will be provided for conservation planning, implementing conservation plans, and for applying and maintaining conservation measures. 1/

Soil surveys are the basic inventories used in developing land use and treatment alternatives 2/. A soil survey has been completed for Escambia County and is available at the SCS field office in Brewton, Alabama. A report of the Escambia County, Alabama Soil Survey is scheduled for publication in 1975. The SCS will furnish the technical assistance necessary to provide soil survey maps needed in the land treatment phase of the watershed program.

Conservation plans on individual units of land are documents that guide deliberate actions to accomplish land treatment. 3/ Conservation planning involves the use of inventory data for study, evaluation, and selection of the future courses of action. Each conservation plan is tailored to fit a particular unit of land by the landowner or landuser with planning assistance of a soil conservationist with the SCS. 4/ The soil conservationist provides technical material and information on soils, water, animals, and plants which are needed by the landowner or landuser in the decision making process.

The conservation plan outlines appropriate uses for each acre of land and the conservation practices needed for sustained production and protection. 5/ The landusers make their own arrangements to install the plans and determine the rate and sequence in which practices will be applied. The SCS, upon request, provides the technical assistance necessary to install the planned conservation practices. This assistance normally involves site investigation, design, layout, and supervision of construction for the more difficult practices such as farm ponds,

terraces, diversions, grassed waterways, and other structural practices. Less complex practices, such as contour farming, usually require only minor surveys and layout work. Management and cultural practices, such as pasture planting and management, require only consultative assistance.

Conservation plans have been developed on 5,943 acres (62 percent) of the 9,610 acres of agricultural land in the watershed, representing 42 ownerships. The conservation planning goal is to develop plans on as much of the remaining 3,667 acres as possible within the five-year installation period.

Conservation land treatment is entirely voluntary on the part of the landowners and landusers. It is therefore proper to set planning and application goals that are conducive to the rate that decision makers are ready, willing, and able to accept. It is anticipated that during the five-year installation period 30 new plans, representing about 2,000 acres, will be prepared. In addition, an estimated 26 of the existing 42 plans will be revised. This means that conservation planning within the watershed area will be accelerated by approximately three times the present rate.

As a result of the planned conservation land treatment program, an estimated 1,024 acres of cropland, 500 acres of pastureland, and 1,600 acres of forest land will be adequately treated by the end of the installation period in addition to what is presently applied.

Adequate conservation land treatment can be obtained on any field by applying a combination of conservation practices suited to the soil properties, land use, and the landuser's desires. Conservation practices to be applied on sloping cropland will be directed toward reducing erosion and resulting soil and water losses. Measures planned for the nearly level cropland will reduce water damage and facilitate more timely field operations. Proposed measures on pastureland will result in quick protective cover, and increased grazing quality and quantity. The major practices planned for application during the five-year installation period include conservation cropping systems, field borders, grassed waterways, terraces, land smoothing, drainage field ditches, drainage mains and laterals, pasture and hayland planting, pasture and hayland management, ponds, and wildlife upland and habitat management.

Conservation Cropping Systems are combinations of cultural and management measures that are very effective in maintaining a good physical condition of the soil and reducing soil and water losses. Conservation cropping systems also include the use of sod crops in the crop rotation systems on soils that are subject to severe erosion.

Field Borders are strips of perennial vegetation at the edges of crop fields. They trap sediment, reduce the rate of surface runoff, facilitate more efficient use of farm equipment, and provide food, shelter, and travel lanes for wildlife.

Grassed Waterways are either natural or constructed water outlets that are established in perennial sod-forming vegetation. They provide safe disposal of concentrated runoff water from fields, diversions, terraces, etc.

Terraces are a series of constructed ridges and channels across the land slope with channel grades designed to safely remove runoff water to stable outlets. They are effective in reducing erosion on sloping cropland.

Land Smoothing is the removal of land surface irregularities. This practice is more commonly used to prepare cropland for installation of terrace systems.

Drainage Field Ditches and Drainage Mains and Laterals are open ditches constructed to designed grades and sizes. Their purposes are to dispose of excessive surface or subsurface water and to control ground water levels.

Pasture and Hayland Planting is the establishment or reestablishment of fields to long-term stands of forage plants. Their purposes are to reduce erosion and/or improve the composition of high quality pasture and hay plants.

Pasture and Hayland Management includes the combination of management and cultural measures that results in the proper treatment and use of pasture or hayland. Its purposes are to prolong life of desirable forage species, maintain or improve the quality and quantity of forage, protect the soil from erosion, and reduce water losses.

Ponds are water impoundments made by either constructing a dam or embankment, or by excavating a pit or "dupout". They are used to provide water for livestock, for fish production, and for wildlife habitat.

Wildlife Upland Habitat Management is retaining, creating, or managing wildlife habitat other than wetland. This practice includes a variety of management techniques for specific non-game as well as game animals. For example, a natural area containing a variety of trees, shrubs, vines, and other plants that provides food, protective cover, and other needs of the desired wildlife species can be retained and managed. A few other commonly used techniques are: planting of food plots for the desired wildlife species, retaining of a portion of a normal agricultural crop, and creating openings in forest land.

The forest land treatment program will consist of reducing wildfires on all forest land through a contactor program of on-the-ground contacts with landowners to inform the public of the hazards of uncontrolled debris burning. Thirty man-months of a local fire prevention contactor will be provided during the installation period by the State Forestry Commission. An accelerated technical assistance program will identify the needs, and create treatment and management plans for 1,600 acres of forest land outside industrial and public ownership. Management plans will be directed toward forest resource management for forest products, wildlife habitat, watershed protection, and environmental enhancement.

It will be the responsibility of the individual landuser, working through the Escambia County Soil and Water Conservation District, to maintain all applied conservation land treatment measures.

Structural Measures

Multiple purpose channels will be installed to supplement or replace presently ineffective channels. Channels are designed to provide flood damage reduction and drainage outlets.

Existing channels in Upper Brushy Creek watershed are small and/or ineffective and poorly defined.

Around the perimeter of the watershed and downstream to approximate station 69+80 on Brushy Creek (see figure 1) there are areas of ponded water with no noticeable flow because of the lack of outlets. Some landowners have attempted to drain these areas by excavating channels (station 55+40 to station 112+00) but the channels have not functioned properly because of inadequate outlets. From approximate station 69+80 downstream to the confluence of a lateral from the City of Atmore with Brushy Creek (station 178+50) there is practically no defined channel, though there is a defined drainage pattern with flow during periods of surface runoff (ephemeral).

Intermittent streamflow occurs from the above mentioned confluence of streams downstream to Escambia County Road No. 1. Downstream from Escambia County Road No. 1, the stream is perennial with a defined, natural channel.

About 37,950 feet (7.2 miles) of channel work is planned with approximately 20,970 feet (4.0 miles) on Brushy Creek main and 16,980 feet (3.2 miles) on six tributaries, as shown on the Project Map, see figure 1. Channels will be excavated to a planned grade and spoil spread to a mowable surface.

Upper Brushy Creek channel from station 112+00 downstream to the end of channel work at station 225+00 and all laterals are designed to remove runoff from the 5-year, 24-hour (U. S. Weather Bureau Technical Paper 40) rainfall in 24 hours. The main channel from station 112+00 upstream to station 15+30 is designed to remove runoff from the 2-year, 24-hour rainfall in 24 hours.

Proposed channels will be constructed primarily through Atmore, Bibb, Escambia, and Grady soil series composed of sandy silt, clay, and sandy clay materials. These soils are poorly drained and occur in capability classes and subclasses IIw, IIIw, IVw, and Vw.

All channel work will consist of excavated channels. Planned channel depth will range from 2.5 feet to 9.0 feet and bottom width from 4 feet to 16 feet, see table 3. Channels will have 3 horizontal to 1 vertical side slopes to insure bank stability and facilitate maintenance except in the vicinity of a proposed grade stabilization structure at approximate station 176+00 on Brushy Creek (see figure 1) where side slopes will be 2 horizontal to 1 vertical.

The grade stabilization structure will be installed to avoid excessive velocities. ^{6/} It will be a steel reinforced concrete drop spillway with rock riprap on the channel side slopes and bottom immediately above and below the structure, see figure 4.

Excavation will be performed by conventional earth moving equipment. Rock is not expected to be encountered during construction. Spoil from excavation through wooded areas will be spread to a maximum height of 4 feet with side slopes of a maximum 3 horizontal to 1 vertical. Spoil from excavation through open land will be spread to a mowable surface with maximum height of 2 feet and side slopes of 4 horizontal to 1 vertical. Channel side slopes, berms, spoil areas, and any other disturbed areas will be vegetated to bermudagrass and Pensacola bahiagrass within a period of seven to ten days following excavation.

Alteration of one culvert and replacement of eight others will be necessary. The culvert requiring alteration is on Alabama Highway 21, while two needing replacement are on Atmore city streets, four are on farm to market roads, and two are on farm roads. The culvert on four-lane Alabama Highway 21 consists of five 8 feet x 10 feet concrete boxes of eighty feet length. Since there is no existing channel, the culvert floor and flood plain elevations are the same. The center box will be lowered approximately four feet and reset with a new concrete bottom and wall extensions. Rock riprap will be placed at the channel approach and exit from the culvert to protect the highway fill, and channel banks and bottom from erosion. This culvert alteration is necessary to provide an

outlet for the planned channel. Concrete box culverts are planned on Brushy Creek main at the crossings of Eighth Avenue and Harris Street. Pipe culverts will be installed on tributaries at four farm to market roads and two farm road crossings.

Two parallel gas pipelines crossing Brushy Creek and laterals 1 & 2, as shown in figure 1, will be either lowered, anchored, or left in their present position depending on existing elevation relative to channel bottom. The pipelines at laterals 1 and 2 will not need alteration.

Culverts and/or rock riprap will be placed on the larger laterals at their confluence with Brushy Creek main to serve as maintenance road crossings and to prevent degradation and erosion near the outlet of the laterals.

Planned channel work will require approximately 215 acres of right-of-way ranging in width from 210 to 300 feet. The needed rights-of-way consist of approximately 40 acres of cropland, 50 acres of pasture and idle land, and 125 acres of forest land. A 59 acre permanent easement is needed for the project. This area consists of 11 acres of cropland, 14 acres of pasture and idle land, and 34 acres of forest land. Acquisition of the needed rights-of-way and installation of the structural measures will not require any displacements of persons, businesses, or farm operations.

In order to minimize water and air pollution and control erosion during construction, the following steps will be taken.

1. Sanitary facilities will be installed according to the requirements of the Occupational Safety and Health Act (OSHA).
2. Measures will be provided at equipment storage and repair areas to prevent contaminants reaching streams and ground water.
3. Clearing prior to excavation will be held to a minimum that will not hamper construction progress.
4. Sediment basins will be constructed in the planned channel bottom approximately 500 feet above and 500 feet below Alabama Highway 21 to protect the flood plain below the planned structural measures from sediment during construction. The basins will have lengths of 200 feet, bottom widths of 8 feet, and bottoms 1.5 feet below the planned channel bottom.

A sediment basin will also be constructed between the outlet on laterals 1 and 2 and an existing farm pond located approximately

1,500 feet below Sunset Drive. This basin will have a capacity of approximately 7,500 cubic feet. These basins will be re-excavated should they fill with sediment before vegetation is established on the areas disturbed during channel construction.

5. Sprinkling will be used to control dust when needed.
6. Culverts and rock structures will be installed on laterals or side drains at their confluence with a main stream prior to proceeding with upstream excavation.
7. Immediately following completion of an excavation reach, the channel side slopes, berms, spoil areas, and other disturbed areas will be vegetated to prevent movement of soil materials downstream.

According to the Department of Anthropology, University of Alabama, no archaeological sites exist within the proposed construction area, however, if sites are uncovered during construction, the Department of the Interior; Chairman, Department of Anthropology, University of Alabama; and Alabama Historical Commission will be notified. If any archaeological sites of value are identified, provisions of Public Law 86-523 will be followed. The project, as planned, will not affect any cultural resources listed in the National Register of Historic Places, nor will it affect any cultural resources eligible for nomination to the National Register of Historic Places.

REFERENCES CITED

- 1/ The Soil Conservation Service, SCS-CI-17, U. S. Government Printing Office, May 1969.
- 2/ Know Your Soil, Agricultural Information Bulletin No. 267, U. S. Government Printing Office, August 1970.
- 3/ National Handbook for Resource Conservation Planning, Soil Conservation Service, 1970.
- 4/ What is a Farm Conservation Plan?, USDA-SCS, PA-629-1965.
- 5/ America's Conservation Districts, National Association of Conservation Districts, League City, Texas.
- 6/ USDA, Soil Conservation Service, Technical Release 25, "Planning and Design of Open Channels".

EXPLANATION OF INSTALLATION COSTS

Land Treatment

The installation cost of conservation land treatment measures on private farm land will be borne by the individual landowners or operators, with technical assistance being provided by the Soil Conservation Service, operating through the Escambia County Soil and Water Conservation District. The PL-566 cost for installation of the land treatment measures is for the technical assistance provided.

Cropland and Pastureland - Public Law 566 will provide \$12,600 to accelerate technical assistance for planning and installing the proposed conservation land treatment measures. The Soil Conservation Service will also provide an estimated \$5,040 in technical assistance under the going program.

Forest land - The estimated cost of the forest land treatment program is \$31,200; of this amount, Public Law 566 will provide \$26,300, and other sources will contribute \$4,900. The PL-566 funds are for accelerated technical assistance for forest management and a local fire prevention contactor program of on-the-ground contacts with landowners and forest users during the fire season (November to April). The contactor program will be administered by the State Forestry Commission. The proposed programs will be paid for by 80 percent to 20 percent cost share of PL-566 funds, and other funds respectively.

The Alabama Forestry Commission will provide \$4,900 for accelerated technical assistance, and the fire prevention contactor program. The landowners will provide the tools, equipment, and funds necessary for treatment of their forest lands. The technical assistance cost is based on present costs of the going cooperative forest management program.

The total estimated installation costs of the planned conservation land treatment measures are as follows: (See table 1)

	<u>PL-566</u>	<u>OTHER</u>	<u>TOTAL</u>
Conservation Land Treatment	\$38,900	\$123,300	\$162,200

Channel Work

The total estimated construction cost of the channel work is \$370,000. Engineering services are estimated to be \$22,200. Of the administrative costs, \$37,000 is for on-site construction inspection and \$22,200 is for record keeping, contract administration, etc., (see table 1). Land

rights are estimated to cost \$43,500; \$28,000 for permanent easements on 59 acres of land and \$15,500 for new culverts and altering existing gas pipelines. Total installation cost of the proposed channel work is \$494,900.

Cost allocation was calculated on the basis of a direct relationship of non-wetland to the total drainage area served by the multiple purpose channel. That portion of the cost of the multiple purpose channel is allocated to flood prevention which is equal to the ratio of the area of non-wetland (1,610 acres or 45 percent) to the drainage area served by the channel (3,580 acres). The remainder of the cost is allocated equally to flood prevention and drainage. For the purpose of determining this ratio, any area benefited by the multiple purpose channel which now has or may require on-farm drainage is classed as wetland. Approximately 1,970 acres, or 55 percent of the land area served by channel work, is classified as wetland.

Of the \$370,000 construction cost, \$268,200 (72.5 percent) is allocated to flood prevention and \$101,800 (27.5 percent) is allocated to drainage. Public Law 566 will bear all the construction cost for flood prevention and 50 percent of the construction cost for drainage. Of the \$101,800 construction cost allocated to drainage, PL-566 will bear \$50,900 and \$50,900 will come from other sources, see table 1. Engineering services costs, project administration costs, and land rights costs will be shared as shown in table 1.

The estimated total Public Law 566 and other obligations for each fiscal year during the installation period are as follows:

Year	Public Law 566 Funds		Other Funds		Total
	Land Treatment	Channel Work	Land Treatment	Channel Work	
1st	8,000	262,800	25,000	68,700	364,500
2nd	8,000	129,500	25,000	33,900	196,400
3rd	8,000	---	25,000	---	33,000
4th	8,000	---	25,000	---	33,000
5th	6,900	---	23,300	---	30,200
TOTAL	38,900	392,300	123,300	102,600	657,100

Approximately 104 acres will be used for channel berms, access roads, and spoil spreading areas. Present land use of this area is 19 acres cropland, 21 acres pastureland or idle land, and 64 acres forest land. With the exception of approximately 10 acres in access roads, this area can be used for agricultural production after project installation.

Construction methods, land treatment measures, and seeding of disturbed areas will result in reduced soil losses and sediment delivery to downstream flood plain areas.

EFFECTS OF WORKS OF IMPROVEMENT

Flood Prevention, Erosion, and Sediment

Planned channel work will provide flood protection and drainage outlets for general farm crops. The upper end of Brushy Creek main channel (Station 15+30 to Station 112+00) will remove runoff from a 2-year, 24-hour storm in 24 hours. 1/ All other channels will remove runoff from a 5-year, 24-hour storm in 24 hours.

The multiple purpose channel work will reduce floodwater damages by 77 percent and will provide efficient drainage outlets on approximately 1,540 acres of agricultural land. The project will reduce flood damages on 430 acres of urban land. Sixty landusers will be directly benefited in terms of increased yields and subsequent incomes. Nine urban dwellings will be directly benefited in terms of reduced flood depth and duration. An indefinite number of urban dwellings will be benefited by improved storm sewer drainage.

Efficiency in farming operations will be improved, producing a trend toward larger farm machinery. This is expected as a result of having larger continuous fields and a reduction or elimination of wet areas. The removal of excess water will allow farming operations to be performed in a more timely and economical manner and harvesting can be completed without unnecessary delays. Yields will increase as farmers will apply more efficient managerial practices after protection is realized. More intensive farming practices can be expected on about 800 acres of soybean land. These effects can be expected to prevail throughout the life of the project.

Due to the nearly level topography necessitating the use of flatland procedures for watershed evaluation, acres flooded by storm frequency is not available. However, a comparison of peak discharges and depths of flooding for future condition without project and future condition with project were made at four locations in the downstream or more defined portion of the benefited area. The locations selected were at Eighth Avenue in Atmore (Station 161+00), a location approximately 1,000 feet above State Highway 21 (Station 200+00), a location approximately 100 feet below the St. Louis and San Francisco Railroad (Station 225+60), and a location approximately 2,100 feet below the lower end of planned channel work (Station 245+60), see figure 1. Comparisons were made for 2-year, 10-year, and 100-year storms. Results of the comparisons are shown on following page.

Storm Frequency	Station No.	Peak Discharge (cfs)		Percent Increase In Peak Discharge	Depth of Flooding (feet)		Change in Depth of Flooding
		Without Project	With Project		Without Project	With Project	
100-year	161+00	1181	1204	2	3.4	2.1	-1.3
24-hour	200+00	2454	2579	5	6.4	5.0	-1.4
	225+60	2656	2805	5	5.4	5.5	+0.1
	245+60	2772	2936	6	4.4	4.5	+0.1
10-year	161+00	728	747	3	2.8	1.2	-1.6
24-hour	200+00	1496	1592	6	5.2	3.7	-1.5
	225+60	1609	1727	7	4.3	4.4	+0.1
	245+60	1674	1804	8	3.5	3.6	+0.1
2-year	161+00	401	415	4	2.2	0.2	-2.0
24-hour	200+00	817	878	7	4.0	2.4	-1.6
	225+60	867	949	9	3.1	3.2	+0.1
	245+60	896	989	10	2.7	2.8	+0.1

The preceding table indicates that flooding produced by the above frequency storms will not be entirely eliminated but depth of flooding will be reduced in areas of high damageable values, especially urban areas in the vicinity of station 161+00. The percent reduction, in depth of flooding, produced by the 100-year, 10-year, and 2-year storms is 38 percent, 57 percent, and 90 percent respectively.

The table also indicates an insignificant increase in depth of flooding on the wooded flood plain immediately below the lower end of planned channel work on Brushy Creek Main (stations 245+60 and 225+60).

The changes in land use expected as a result of the project installation are as follows:

Land Use	Future Without Project (Ac.)	Future with Project (Ac.)
Cropland	5,600	5,700
Pastureland	880	955
Forest land	3,130	2,925
Urban	870	900
Miscellaneous & Idle	500	500
TOTAL	10,980	10,980

The planned channel work will necessitate the direct loss of about 75 acres of bottom land forest composed mostly of sweet gum and yellow poplar. This forest land represents poor quality game animal habitat but does have some value for non-consumptive species of wildlife, especially birds. Of this 75 acres, 11 acres are committed to the channel, the remainder can be used for agricultural production or other purposes after project installation. It is estimated that an additional 100 acres of poor quality slash pine forest will be cleared for agricultural production as a result of the drainage provided by the project.

Following the installation of planned land treatment measures, the estimated average annual gross erosion rates will be reduced as follows:

Land Use	Present Soil-Loss (Tons/Acre)	Future with Project Soil-Loss (Tons/Acre)	Percent Reduction
Cropland	7.03	4.63	34
Pastureland	.30	.20	33
Forest land	.15	.11	26
Urban land	.42	.42	--
Idle land	.36	.14	61
Misc. land	.71	.71	--

This erosion is generally within the accepted soil-loss tolerance levels, therefore, maximum productivity can be economically sustained.

The project will result in 3,124 acres being adequately treated during the installation period. This includes 1,024 acres of cropland, 500 acres of pastureland, and 1,600 acres of forest land. The entire acreage of forest land will have fire protection.

Crop production will be increased on lands where conservation practices are applied. Land drainage will improve soil conditions, improve the physiological functions of cultivated crops, and facilitate more efficient use of added plant nutrients. 2/ Conservation practices such as conservation cropping systems and terracing will control soil erosion, reduce sediment, and increase crop yields. 3/

The installation of conservation practices will reduce soil losses and runoff water and will have a significant effect on reducing the loss of agricultural chemicals into streams. 4/

Improved farming efficiency is expected after the removal of excess water and elimination of wet areas. Conservation land treatment will improve the water intake rate and water holding capacity of the spoil.

The existing, non-damaging sediment accumulation on forest lands in the lower part of the watershed will be reduced by 33 percent with land treatment in the uplands. This will enhance alluvial soil suitability.

Erosion of the existing channel is not a major problem, but will increase during and immediately after construction with a decline and stabilization following the first year. Streambank erosion will occur on about 24 acres as a result of channel work. It is estimated that, under average rainfall and runoff conditions, an average of 50 tons of sediment will be produced from each of the 24 affected acres. This could result in an increase of 1,200 tons of sediment at the mouth of the watershed. However, sediment traps excavated prior to channel construction will trap approximately 70 percent of this additional sediment during the first year.

A grade stabilization structure will be installed as part of the channel work to help improve channel stability. Flattened side slopes (3:1) and the establishment of vegetation will stabilize channel bank erosion at an estimated 6 tons per acre per year after the first year. Predicted future erosion after installation of the project including land treatment will yield 3,100 tons of sediment (257 mg/l) annually at the outlet of the soil and water problems area and 7,250 tons (193 mg/l) at the outlet of the watershed. This represents a net sediment yield reduction of 27 and 32 percent respectively for the soil and water problems area and the total watershed.

Fish and Wildlife Resources

The entire project area, except that portion within the city limits, is available for upland game hunting with the permission of the landowner. The project is not expected to have a significant impact on game resources because most of the watershed is presently in cropland or open land and the land to be cleared for project installation has low value for game animal habitat.

Two small farm ponds provide some warm water fishing. Stream fishing is practically non-existent in the watershed. The project will have no effect on the fishery resource. The project will have little or no effect on wildlife and wildlife habitat due to the paucity and the poor quality of these resources in the project area.

The proposed project will have little or no adverse effects on any of the endangered or threatened species with the possible exception of the rainbow snake and the flatwoods salamander, if indeed these species

exist here. There is low probability that the rainbow snake exists in the area affected due to unsuitable habitat. The rainbow snake inhabits streams and relies on the eel as a major food source. Dams could prevent the upstream migration of young eels and thus adversely affect the snake, however, no dams are planned. The alteration of the stream itself could destroy some rainbow snake habitat.

The flatwoods salamander is one of the rarest salamanders in Alabama. As states on page 28, it is "highly probable" that this species occurs in the affected area although it has not been reported. The breeding sites are usually cypress ponds and swamp margins of small streams. Alteration of the natural waterways and wetland drainage constitutes a direct threat to the survival of this species. If the flatwoods salamander uses the wet areas along the stream channel, the proposed project will affect this species. The magnitude of adverse effects is unknown.

Archaeological, Historical, and Unique Scenic Areas

According to the National Register of Historic Places and the Alabama Historical Commission, no known sites of historical or unique scenic values exist within the watershed. Also, the University of Alabama Department of Anthropology and Archaeology is unaware of any significant sites of archaeological value in the watershed area.

If previously unidentified archaeological or historical materials are found during construction, the State Conservationist will be notified by telephone so that the Department of Interior, Department of Anthropology-University of Alabama, and Alabama Historical Commission can be notified immediately. The Code of Alabama specifically reserves to the State the right to explore and excavate archaeological and historical remains, claim their contents as property of the State, and prohibits defacing such remains. Therefore, if such remains are uncovered during construction, the contractor will be advised not to proceed with unearthing such remains.

Economic and Social

The flood damage reduction and improved drainage efficiency provided by the proposed project will increase per capita agricultural incomes by an estimated average of \$850 on each farm within the benefited area. Yields will increase, especially soybeans, when flooding and drainage problems are reduced. It is expected that, after project installation, farmers will farm more intensively and on a more timely basis. Fertilizers and agricultural chemicals can also be used more efficiently. It is estimated that the total effect of the project will increase soybean yields by about 55 percent.

The channel construction will create an estimated 14 man-years of employment for local labor during the two years of channel construction. Operation and maintenance of the channel will provide an additional 0.5 man-year employment annually during the 100-year life of the project.

The quality of living will be enhanced especially within the urban sector. Storm sewers and urban drainage ditches will function more effectively. Septic tanks and field lines will operate more efficiently, especially along Crow Street, thereby improving sanitary conditions.

This project will help develop the rural area by providing drainage outlets for mains and laterals that have already been installed and do not have an adequate outlet. Also further development of the rural community can be accomplished once the project is installed.

Other

Approximately 28 acres will be committed to the planned channel as compared to an estimated 8 acres occupied by the existing channel. The increase of 20 acres is due mainly to the inadequate size of existing channels in some valley reaches and the increased width of the planned channel over that of the existing channel. This 20 acre area is composed of 4 acres cropland, 5 acres pastureland, and 11 acres forest land.

REFERENCES CITED

- 1/ U. S. Weather Bureau Technical Paper 40 "Rainfall Frequency Atlas of the United States".
- 2/ Improved Drainage Systems for Agricultural Lands, Soil and Water Research, USDA-Agricultural Research Service.
- 3/ Elking, C. B., Frank Lowry and Jordan Langford, Alleviation of Mechanical Impedance to Cotton Rotting in a Dense Subsoil by Use of a Sod, Report at Annual Meeting of Am. Soc. of Agron., Las Vegas, Nevada, November 1973.
- 4/ Bailey, G. W., A. P. Barnett, W. R. Payne, Jr., and C. N. Smith, "Runoff of Atrazine and Dichlobenil from Four Coastal Plains Soil Types with Simulated Rainfall", Paper presented at Annual Meeting of Am. Soc. of Agron., Miami Beach, Florida, 1972.

PROJECT BENEFITS

The future without project average annual floodwater crop and pasture damages are estimated to be \$31,700. Estimated average annual crop and pasture damage reduction benefits are \$24,350. Annual road and bridge and urban flood damage reduction benefits are estimated at \$750 and \$1,400 respectively, see table 5. Structural measures (channel work) are estimated to provide \$28,100 in flood damage reduction benefits and \$8,850 in improved drainage benefits, see table 6. Conservation land treatment measures will provide an estimated \$1,100 in reduced flood damages annually.

As flood protection is realized and drainage outlets are provided, some land will become productive that is presently idle or too wet for agricultural use. Also, farmers will apply more intensive land use practices when protection is realized. Changed land use and more intensive land use benefits are estimated to be \$7,600 and \$10,700 respectively, see table 6.

The value of local secondary benefits is estimated at \$5,150 annually. These benefits result from the supplying of additional materials and services required to make possible the increased net returns which stem from the installation of the project facilities. An example would be the increased net income of a fertilizer and seed dealer from agricultural sales to the producers of the project area. Secondary benefits from a national viewpoint were not considered pertinent to the economic evaluation of the project.

Redevelopment benefits for providing employment to local labor that would otherwise be unemployed or underemployed are estimated to average \$7,000 annually. The benefits will accrue to the local economy from the values of local labor, services, and materials used for project installation and for operation and maintenance.

Average annual project benefits are estimated as follows: (Table 6)

Flood Damage Reduction	\$28,100
More Intensive Land Use	10,700
Changes Land Use (Agricultural)	7,600
Drainage (Improved Efficiency)	8,850
Redevelopment	7,000
Secondary	<u>5,150</u>
Total	\$67,400

COMPARISON OF BENEFITS AND COSTS

The average annual benefits WITHOUT local secondary benefits are an estimated \$62,250. With an estimated average annual cost of \$31,400, the benefit-cost ratio WITHOUT local secondary benefits is 2.0:1.0.

The total average annual benefits estimated to accrue to structural measures are \$67,400 and total average annual costs are \$31,400. This gives a benefit-cost ratio of 2.1:1.0, table 6.

PROJECT INSTALLATION

Land Treatment Measures

Individual farmers will establish land treatment measures on private land within the 5-year installation period in cooperation with the Escambia County Soil and Water Conservation District. The District will provide technical assistance for the planning, application, and maintenance of land treatment measures. The Soil Conservation Service, using PL-566 funds, will supplement the assistance provided under the going district program. This additional technical assistance will accelerate the rate of planning and application of land treatment measures.

The Alabama Forestry Commission, in cooperation with the U. S. Forest Service, will provide technical assistance in the planning and application of forest land treatment measures. They will provide additional technical assistance for fire control through a local fire prevention contactor program. The individual landowners or operators will provide the necessary tools, equipment, and funds which are necessary for forest land treatment.

Structural Measures

The Escambia County Commission and the City of Atmore will acquire all necessary land rights for installation of structural measures. The City will be responsible for obtaining needed land rights and arranging for the modifications of any roads, utility lines, etc., needed to install the works of improvement within the city limits of Atmore. The County Commission will have the same responsibilities for the remaining works of improvement. Powers granted by the state, including the power of eminent domain, will be used if necessary to obtain the necessary land rights. All necessary land rights will be acquired before PL-566 funds are made available.

The Escambia County Commission will be the contracting agent for the sponsoring local organizations and will be responsible for working with the Soil Conservation Service during project installation. The County Commission, using county equipment and labor, will perform a portion of the channel excavation under a "Performance of Work" arrangement. Service-approved cost estimates will establish the maximum price that may be negotiated for the work the County Commission will perform. The County Commission will contract for the construction of the remainder of the structural measures.

The County Commission will develop and maintain a financial management system which will provide for accurate, current, and complete disclosure of the financial results of each PL-566 undertaking in which the Soil Conservation Service has a financial interest in accordance with SCS reporting requirements. The system will provide for effective control over and accountability for all funds, accounting records, and periodic audits by the sponsors. The State Administrative Officer of the SCS must determine that the financial management system meets SCS requirements, as stated in the Administrative Services Handbook, prior to approval of SCS fund obligating agreements.

The Soil Conservation Service will prepare plans, specifications, cost estimates, provide construction inspection, and cooperate in the final inspection of all structural measures.

Clearing prior to excavation will be held to a minimum that will not hamper construction progress.

Culverts and rock structures will be installed on laterals or side drains at their confluence with a main stream prior to proceeding with upstream excavation.

Immediately following completion of an excavation reach the channel side slopes, berms, spoil areas, and other disturbed areas will be vegetated to prevent movement of soil materials downstream.

Structural measures should be installed in the following general sequence. A sediment basin will be constructed between Sunset Drive and an existing farm pond approximately 1,500 feet below Sunset Drive. Lateral #1 with two pipe culverts, and Lateral #2 with one pipe culvert will be installed following completion of the sediment basin. Channel work on Brushy Creek main will begin at station 225+00 in the vicinity of the St. Louis-San Francisco Railway and proceed upstream to approximate station 209+00, immediately above Alabama Highway 21, with a sediment basin being excavated approximately 500 feet below the highway. Upstream channel excavation will be discontinued until alteration of a concrete box culvert under Alabama Highway 21 is completed. Excavation will then be continued upstream to approximate station 160+00, immediately above 8th Avenue, with a sediment basin being excavated approximately 500 feet above Alabama Highway 21. Excavation will be discontinued until a concrete drop spillway structure is installed approximately 250 feet below Harris Street and concrete box culverts installed at Harris Street and 8th Avenue. Following completion of the concrete structure, excavation will proceed upstream to Lateral #4 (approximate station 123+60). Lateral #4, including a pipe culvert, will be installed before proceeding upstream with excavation on Brushy Creek main to Lateral #5 (approximate station 93+30). Lateral #5 will be installed before proceeding upstream with excavation on Brushy Creek main to Lateral #6 (approximate station 69+80). Lateral #6, including two pipe culverts, will be installed before proceeding upstream with excavation on Brushy Creek main to

Lateral #7 (approximate station 55+40). Lateral #7 will be installed before proceeding upstream with excavation to the end of planned channel work at approximate station 15+30.

FINANCING PROJECT INSTALLATION

Federal assistance for installing the works of improvement on non-federal land, as described in this work plan, will be provided under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress; 68 Stat. 666), as amended. This assistance is contingent on the appropriation of funds for this purpose and the sponsoring local organizations meeting their necessary prior obligations. Structural measures will be installed pursuant to the following conditions:

1. All land rights have been acquired for all structural measures.
2. PL-566 funds are available.
3. Project agreements have been executed.
4. Operation and maintenance agreements have been executed.

The land treatment measures will be voluntarily installed by the land-owners and operators at their own expense. Cost sharing assistance under the Rural Environmental Assistance Program administered by the Agricultural Stabilization and Conservation Service is available in applying certain conservation land treatment measures. PL-566 funds will finance the accelerated technical assistance provided by the Soil Conservation Service in applying the land treatment measures.

PL-566 funds will be used to finance 80 percent of the fire prevention contactor program. The remaining 20 percent will be borne by the State Forestry Commission from appropriated funds.

The portion of the installation cost of the multiple purpose channel work to be borne by the federal government will be financed by PL-566 funds. The County Commission and the City of Atmore will finance the cost incurred in acquiring the land rights for which each is responsible. These funds will be provided from existing and adequate tax sources. Most of the easements are expected to be donated.

The sponsor's portion of the construction cost of the multiple purpose channel work is to be provided by the Escambia County Commission under "Performance of Work". The quantity and value of such work will be determined by mutual agreement between the sponsors and the Soil Conservation Service and will be set forth in the project agreement.

PROVISIONS FOR OPERATION AND MAINTENANCE

Land treatment measures will be maintained by landowners under the cooperative agreements with the Escambia County Soil and Water Conservation District, the Escambia County Commission, and the City of Atmore. The Soil Conservation Service will provide technical assistance through the District for operation and maintenance of land treatment measures.

The forest land treatment measures will be maintained by the landowners and operators under agreement with the Escambia County Soil and Water Conservation District. The Alabama Forestry Commission, in cooperation with the U. S. Forest Service, will furnish technical assistance necessary for operating and maintaining the forest land treatment measures under the going Cooperative Forest Management Program. The Alabama Forestry Commission will continue to furnish fire protection under the Cooperative Forest Fire Control Program.

The Escambia County Commission will be responsible for and promptly perform, or have performed, without cost to the Service, all maintenance of the structural measures as determined to be needed by either the sponsors or the Service immediately following completion of the structures by the contractor. The County Commission will be responsible for maintenance of vegetation associated with the channel work after the initial vegetation work is adequately completed, as determined by the Service, but not later than three years following completion of the channel work. The estimated average annual cost of operation and maintenance is \$2,200.

Immediately following the construction of the channel a three year establishment period will begin. During this period intensive programs for establishing vegetative cover will be implemented. The cost of any additional structural measures needed to assure stability and repair of minor damages will be shared between PL-566 and other funds by the same percentage as the construction cost, (86.25% and 13.75% respectively). Items of normal maintenance such as mowing, removal of debris, etc., will be performed by the Escambia County Commission at no cost to the Service.

The County is primarily responsible for seeing that operation and maintenance is performed in a timely, adequate, and otherwise appropriate manner to assure efficient operation and functioning of the multiple purpose channel for the life of the project. The City of Atmore will continue to administer and enforce the existing land use regulations in the flood plain areas to minimize future flood damages.

Channel maintenance includes such activities as periodic cleanouts necessary to restore channels to their planned capacities, repairing of eroded areas or washouts on channel banks, control of vegetation that will reduce channel capacities, and repair or replacement of side inlets and other structures. Maintenance of the grade stabilization structure includes painting metal parts, repairing rills around headwalls or wingwalls, and maintaining or replacing vegetation on fills. Maintenance and improvement of the general attractiveness or beauty of the channel and structure shall be considered as important features of the maintenance program.

Structure and channel operations require little or no manual manipulation. Structures affecting two or more landowners will require coordination to assure that each landowner has the opportunity to realize the intended project objective.

An annual inspection program will be carried out and documented by a responsible official of the county, preferably accompanied by a landowner actively farming in the vicinity. A copy of the findings of this annual inspection will be sent to the Soil Conservation Service. The annual inspection will be made during the dry season, soon after the end of the rainy season so as to make it possible to complete needed maintenance before the start of the next rainy season. Items to be inspected include all components of the structural works of improvement.

The Soil Conservation Service and the Escambia County Soil and Water Conservation District will participate in the inspections in the first three years and thereafter as deemed necessary. These inspections, regardless of participants, should be made soon after major storms or periods of unusually heavy rainfall so as to locate any needed maintenance caused by the event. Years with major storms early in the season may require inspections at more frequent intervals than 12 months. The intent is to accomplish needed maintenance prior to the recurring storm that might seriously aggravate the situation. Existing drainage systems, natural and improved, and particularly those downstream of project works, will receive maintenance similar to that specified for the project works.

An operation and maintenance (O&M) agreement will be entered into by the county and the Service prior to the signing of a project agreement. The O&M agreement will contain, in addition to specific sponsor responsibilities for structural measures, specific provisions for retention and disposal of real and personal property acquired in whole or in part with PL-566 funds. The O&M agreement will also contain a reference to the State Watersheds Operation and Maintenance Handbook. An O&M plan will be prepared for the channel work.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Upper Brushy Creek Watershed, Alabama

Installation Cost Item	Unit	NUMBER	ESTIMATED COST (DOLLARS) 1/						
			PL-566 Funds			Other			
			Non-Federal Land			Non-Federal Land			
			S.C.S. 3/	F.S. 3/	Total	S.C.S. 3/	F.S. 3/	Total	Total
LAND TREATMENT									
Land Areas 2/									
Cropland	Acres to be treated	1,024	---	---	---	67,300	---	67,300	67,300
Pastureland		500	---	---	---	46,100	---	46,100	46,100
Forest land		1,600	---	19,500	19,500	---	3,600	3,600	23,100
Technical Assistance	---	---	12,600	6,800	19,400	5,000	1,300	6,300	25,700
TOTAL LAND TREATMENT	XXX	XXX	12,600	26,300	38,900	118,400	4,900	123,300	162,200
STRUCTURAL MEASURES									
Construction (M) 4/	Miles	1.4	54,300	---	54,300	8,650	---	8,650	62,950
Channel Work (O)		5.8	264,800	---	264,800	42,250	---	42,250	307,050
Subtotal-Construction	Miles	7.2	319,100	---	319,100	50,900	---	50,900	370,000
Engineering Services	---	---	22,200	---	22,200	---	---	---	22,200
Project Administration									
Construction Inspection	---	---	31,900	---	31,900	5,100	---	5,100	37,000
Other	---	---	19,100	---	19,100	3,100	---	3,100	22,200
Subtotal-Administration	---	---	51,000	---	51,000	8,200	---	8,200	59,200
Other Costs									
Land Rights	---	---	---	---	---	43,500	---	43,500	43,500
TOTAL STRUCTURAL MEASURES	---	---	392,300	---	392,300	102,600	---	102,600	494,900
TOTAL PROJECT	---	---	404,900	26,300	431,200	221,000	4,900	225,900	657,100

1/Price base 1973.

2/Includes only areas estimated to be adequately treated during project installation period. Treatment will be accelerated throughout watershed, dollar amounts apply to total land areas, not just adequately treated areas.

3/Federal agency responsible for assisting in installation of works of improvement.

4/Type of channel prior to project (M) - Man-made ditch or previously modified channel.

(O) - Practically no defined channel.

May 1975

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
(at time of Work Plan preparation)

Upper Brushy Creek Watershed, Alabama

LAND TREATMENT	UNIT	APPLIED TO DATE	TOTAL COST <u>1/</u> (DOLLARS)
Conservation Cropping System	Ac.	3,871	123,870
Field Borders	Ft.	16,465	500
Ponds	No.	2	1,500
Grassed Waterways	Ac.	16	2,720
Pasture and Hayland Planting	Ac.	203	13,200
Pasture and Hayland Management	Ac.	143	2,860
Terracing	Ft.	104,718	6,280
Wildlife Habitat Management	Ac.	28	1,550
Drainage Field Ditches	Ft.	16,450	3,620
Drainage Mains and Laterals	Ft.	19,540	10,750
Diversions	Ft.	1,300	1,370
TOTAL			168,220

1/ Price base 1973.

May 1975

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION
Upper Brushy Creek Watershed, Alabama
(Dollars) 1/

ITEM	INSTALLATION COST P. J.. 566 FUNDS			INSTALLATION COST - OTHER FUNDS			TOTAL INSTALLATION COST
	Construction	Engineering	TOTAL P.L. 566	Construction	Land Rights	Other	
Channel Work							
Upper Brushy Creek							
15+30-55+40 (O) 3/	23,300	1,600	24,900	3,700	2,900	6,600	31,500
55+40-112+00 (M) 3/	47,550	3,300	50,850	7,600	4,800	12,400	63,250
112+00-225+00 (O)	162,750	11,300	174,050	25,950	18,700	44,650	218,700
Lateral 1							
36+50-68+50 (O)	20,100	1,400	21,500	3,200	4,700	7,900	29,400
Lateral 2							
5+00-67+50 (O)	24,900	1,750	26,650	4,000	5,100	9,100	35,750
Lateral 4							
18+00-25+00 (O)	7,000	500	7,500	1,100	1,200	2,300	9,800
Lateral 5							
14+00-19+50 (O)	4,150	300	4,450	650	400	1,050	5,500
Lateral 6							
2+00-45+20 (O)	22,650	1,600	24,250	3,600	4,900	8,500	32,750
Lateral 7							
16+00-35+60 (M)	6,700	450	7,150	1,100	800	1,900	9,050
SUBTOTAL	319,100	22,200	341,300	50,900	43,500	94,400	435,700
Project Admin.	---	---	51,000	---	---	8,200	59,200
GRAND TOTAL	319,100	22,200	392,300	50,900	43,500	102,600	494,900

1/ Price base 1973.

2/ Includes \$15,000 for new culverts, \$28,000 for easements and rights-of-ways, and \$500 for anchoring gas pipe line.

3/ (O) - Practically no defined channel.

(M) - Man-made ditch or previously modified channel

May 1975



TABLE 2A - COST ALLOCATION AND COST SHARING SUMMARY

Upper Brushy Creek Watershed, Alabama

(Dollars) 1/

Item	COST ALLOCATION			COST SHARING			
	PURPOSE			P. L. 566			
	Flood Prevention	Drainage	Total	Flood Prevention	Drainage	Total	OTHER
Channel Work	315,900	119,800	435,700	284,400	56,900	341,300	31,500
							62,900
							94,400
GRAND TOTAL	315,900	119,800	435,700	284,400	56,900	341,300	31,500
							62,900
							94,400

1/ Price base -1973.

May 1975

TABLE 3 - STRUCTURE DATA

CHANNELS
Upper Brushy Creek Watershed, Alabama

Channel Designation	Reach		Drainage Area (Sq. Mi.)	Capacity		Water Surface Elevation ^{1/} (ft./ft.)	Hydraulic Gradient (ft./ft.)		Channel Dimensions		"n" Value		Velocities		Excavation (Cu. Yds.)	Type of Work ^{2/}	Type of Channel Before Project ^{5/}	Flow Condition Before Project ^{6/}
	Station (ft.)	Station (ft.)		Req'd (cfs)	Design (cfs)				Bottom	Depth	Slope	Side	As Built	As Aged				
Upper Brushy	15+30	55+40	0.42	33	41	288.0	.0005	.0005	4	3.0	3:1		1.05	1.89	10,124	I	O	S
	55+40	69+80	0.65	48	49	287.2	.0005	.0005	6	3.0	3:1		1.09	1.96	5,080	I	M(1966)	S
	69+80	112+00	1.50	93	93	285.0	.0005	.0005	6	4.0	3:1		1.29	2.32	17,140	I	M(1966)	E
	112+00	123+60	1.50	130	163	282.6	.0021	.0021	4	4.0	3:1		2.54	4.57	2,921	I	O	E
	123+60	144+00	2.30	186	185	280.8	.0009	.0009	4	4.8	3:1		2.09	3.34	7,467	I	O	E
	144+00	176+00	2.75	220	260	275.1	.0018	.0018	4	4.8	3:1		2.95	4.72	13,105	I	O	E
	176+00	178+50	2.80	220	255	270.2	.0012	.0012	9	5.0	2:1		2.68	4.29	2,074	I	O	E
	178+50	193+00	3.80	283	289	268.5	.0012	.0012	7	5.0	3:1		2.63	4.21	10,624	I	O	I
	193+00	198+50	3.80	283	278	268.1	.0007	.0007	9	5.0	3:1		2.30	3.68	2,852	I	O	I
	198+50	225+00	5.13	363	353	266.5	.0006	.0006	16	5.0	3:1		2.28	3.65	11,820	I 3/	O	I
Subtotal															83,207			
Lateral 1	36+50	69+50	0.56	57	151	279.0	.0005	.0005	4	5.0	3:1		1.59	2.86	10,113	I 4/	O	S
Lateral 2	5+00	30+50	0.23	28	79	285.9	.0005	.0005	4	4.0	3:1		1.24	2.23	5,693	I	O	S
	30+50	67+50	0.43	46	123	279.0	.0012	.0012	4	4.0	3:1		1.92	3.46	5,863	I 4/	O	E
Subtotal															11,556			
Lateral 4	18+00	25+00	0.28	32	79	282.6	.0005	.0005	4	4.0	3:1		1.24	2.23	1,462	I	O	S
Lateral 5	14+00	19+50	0.08	11	62	285.9	.0005	.0005	4	3.6	3:1		1.17	2.11	1,497	I	O	S
Lateral 6	2+00	23+40	0.36	40	40	288.5	.0006	.0006	6	2.6	3:1		1.11	2.00	4,187	I	O	S
	23+40	45+20	0.46	49	51	287.2	.0006	.0006	9	2.6	3:1		1.16	2.09	5,701	I	O	S
Subtotal															11,778			
Lateral 7	16+00	35+60	0.16	20	40	288.0	.0013	.0013	4	2.6	3:1		1.48	2.66	4,543	I	M(1966)	S
Grand Total															122,356			

1/ The water surface elevation shown for each reach represents the elevation of the water surface profile at the lower end of the reach.

2/ I - Establishment of new channel including necessary stabilization measures.

3/ Channel work from Station 210+60 to Station 225+00 required primarily to provide an outlet for the benefited area upstream. The hydraulic grade line is located above the flood plain allowing out-of-channel flow of the design discharge.

4/ Hydraulic grade line is located above flood plain in lower portion of reach with channel discharging into a well-defined sodded draw.

5/ O - Practically no defined channel.

M() - Manmade ditch or previously modified channel (approximate date of original major construction in parenthesis).

6/ E - Ephemeral - flows only during periods of surface runoff, otherwise dry.

S - Ponded water with no noticeable flow - caused by lack of outlet or high groundwater table.

I - Intermittent - Continuous flow through some seasons of the year but little or no flow through other seasons.

May 1975

TABLE 3A - STRUCTURE DATA

GRADE STABILIZATION STRUCTURE

Upper Brushy Creek Watershed, Alabama

Station	Drainage Area (Sq. Mi.)	Design. Cap. (cfs)	Assoc. Frequency and Duration of Storm	Drop (Feet)	Concrete (Cu. Yds.)	Type of Structure
Sta. 176+00 Brushy Creek	2.75	293	5-year 24- hour ^{1/}	5.4	55	Reinforced Concrete Drop Spillway

^{1/} Runoff from the 5-year 24-hour rainfall of U. S. Weather Bureau Technical Paper No. 40, Rainfall Frequency Atlas of the United States, will be removed in 24 hours.

May 1975

TABLE 4 - ANNUAL COST

Upper Brushy Creek Watershed, Alabama
(Dollars) 1/

Evaluation Unit	Amortization of Installation Cost <u>2/</u>	Operation and Maintenance Cost	Total
Channel Work	25,700	2,200	27,900
Project Administration	3,500	XXXXXXXX	3,500
GRAND TOTAL	29,200	2,200	31,400

1/ Price base 1973.

2/ 100-years @ 5 7/8 percent interest.

May 1975



TABLE 5 - ESTIMATED AVERAGE ANNUAL FLOOD
DAMAGE REDUCTION BENEFITS

Upper Brushy Creek Watershed, Alabama
(Dollars) 1/

Item	Estimated Average Annual Damage		Damage Reduction Benefit
	Without Project	With Project	
<u>Floodwater</u>			
Crop and Pasture	31,700	7,350	24,350
Nonagricultural			
Road & Bridge	1,000	250	750
Urban	2,130	730	1,400
Subtotal	34,830	8,330	26,500
Indirect	3,700	1,000	2,700
<u>TOTAL</u>	38,530	9,330	29,200

1/ Price base - current normalized for agricultural damages and 1973 prices for non-agricultural damages.

May 1975



TABLE 6 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES
Upper Brushy Creek Watershed, Alabama

Evaluation Unit	AVERAGE ANNUAL BENEFITS <u>1/</u>							Average Annual Cost <u>2/</u>	Benefit-Cost Ratio
	Flood Damage Reduction	More Intensive Land Use	Changed Land Use Agricultural	Drainage	Redevelopment	Secondary	Total		
Channel Work	28,100 <u>3/</u>	10,700	7,600	8,850	7,000	5,150	67,400	27,900	2.4:1.0
Project Administration	---	---	---	---	---	---	---	3,500	---
GRAND TOTAL	28,100	10,700	7,600	8,850	7,000	5,150	67,400	31,400	2.1:1.0

1/ Price base - Current normalized for agricultural benefits and 1973 for non-agricultural benefits.

2/ From Table 4.

3/ In addition, it is estimated that land treatment measures will provide flood damage reduction benefits of \$1,100 annually.

May 1975

INVESTIGATIONS AND ANALYSES

Conservation Land Treatment

Present land use within the watershed was determined by studying conservation plans and aerial photographs. Land use trends were then evaluated by consulting various published data relative to the watershed area. Individual interviews with landowners gave additional insight as to future with project land use.

Cropland and pastureland problems were evaluated by consulting the SCS field office in Escambia County and reviewing conservation plans in the watershed area. Some of the farmers were contacted and interviewed to determine land use problems and treatment needs. On-site field studies were made to further determine present land treatment needs.

Soils survey maps and soils interpretation data were used to determine land suitability for the various land uses. Soil losses were determined for each land use within the watershed. Erosion rates were calculated during the Universal Soil-Loss Prediction Equation for each land use and conservation land treatment measures were then planned that would reduce these erosion rates to acceptable levels. The conservation land treatment measures listed in the work plan are those amounts that can be accomplished during the 5-year installation period.

Hydraulic and Hydrologic

After a field reconnaissance of the watershed and stereoscopic study of aerial photographs, field surveys were made at predetermined locations for fifty valley cross-sections, nine bridge openings, and numerous areas needing drainage. The IBM 1130 Computer was used in developing stage-discharge relationships for 22 valley cross-sections beginning approximately one mile below Escambia County Road No. 1 and extending upstream to the east or upper city limits of Atmore. These stage-discharge relationships were developed for both without project and with planned channel installed.

Consideration was given to soil classification, land use, and vegetative cover in determining the Antecedent Moisture Condition II Future Condition Runoff Curve Number 82 for the major soil and water problems area. This curve number was used in accordance with Technical Release No. 16, "Rainfall-Runoff Tables for Selected Runoff Curve Numbers", in determining inches runoff for storms to be routed.

Runoff from four storms, selected from the U. S. Weather Bureau publication "Rainfall Frequency Atlas of the United States, Technical Paper No. 40", were valley flood routed through the problems area for two alternates. These alternates were future condition without project and future condition with channel work. The storms routed were the 100-year, 25-year, 10-year, and 2-year frequency 24-hour duration storms. The Convex Method of valley flood routing was performed using the IBM 1130 Computer and Technical Release 20, Project Formulation Program -- Hydrology.

Water surface profiles were developed through a stream reach along the north outskirts of Atmore for each of the four routed storms. These profiles were used to indicate depth of inundation in evaluating urban floodwater damage.

Engineering

A field reconnaissance of Upper Brushy Creek Watershed indicated a need for channel work in the major problems area in order to provide protection from floodwater and drainage damages for general farm crops.

Section 16 of the SCS National Engineering Handbook, "Drainage of Agricultural Land", was used as a reference in selecting the level of protection planned. The selected level of protection was based on land use, crop requirements, construction costs, required modifications, etc.

The coefficient "C" for the surface drainage formula $Q=CM^{5/6}$ was obtained from the relationship given in the Agricultural Research Service publication ARS-41-95, "Using the Cypress Creek Formula to Establish Runoff Rates in the Southern Coastal Plain and Adjacent Flatwoods Land Resource Areas" by Stephens and Mills. Values of "C" obtained were 93 for removing the 5-year runoff and 68 for removing the 2-year runoff.

It was determined that a grade stabilization structure will be necessary to reduce channel grades and maintain channel flow velocities within the allowable range set forth by USDA, Soil Conservation Service, Technical Release (TR-25) - Planning and Design of Open Channels. This structure (table 3A) will be a reinforced concrete drop spillway (figure 4). Velocities of flow in the planned channels under "as built" conditions will range from 1.89 feet per second in the upper reaches of the main channel, and in Lateral #7 to 4.72 feet per second for approximately 3,000 feet immediately above the drop spillway on the main

channel. The range of corresponding velocities expected after the channels have aged are 1.05 to 2.95 feet per second. The velocities for "as built" channels were calculated using an "n" value (coefficient of roughness) of 0.025 while "n" values of 0.035, 0.040, and 0.045 were used in calculating velocities of aged channels (see table 3).

The investigation made to determine channel stability included the auger boring of ten locations for field examination of soils and the collection of five representative samples for laboratory classification. The basic non-scouring and maximum allowable design velocities were calculated for each soil material using the appropriate formulae from TR-25. The design aged velocity is below the TR-25 maximum allowable velocity computed for each reach. The channel design meets the stability requirements for the as-built condition except for the channel from Station 123+60 to Station 144+00, Station 193+00 to Station 198+50, and Station 198+50 to Station 225+00 on Upper Brushy main, and on laterals nos. 1 and 2. At these locations, the as-built velocities exceed the TR25 maximum allowable velocities by less than one foot per second. Should instability result through erosion or aggradation, the provisions of the establishment period outlined in the Operation and Maintenance section of this plan will be followed.

Field surveys indicated the necessity for alteration of one culvert and replacement of eight others in order to have an effective channel. The surveys also indicated twin gas pipelines at station 112+00 on Brushy Creek (see figure 1) will either need lowering or anchoring. These pipelines will not need alteration where they cross beneath laterals #1 and #2 near Sunset Drive.

Culverts and/or rock riprap will be placed on the larger laterals at their confluence with Brushy Creek to serve as maintenance road crossings and to prevent degradation and erosion near the outlet of the laterals.

Economics

Information used in economic evaluation was obtained from local farmers, experiment stations, and U. S. Department of Agriculture publications. The methods followed are in accordance with instructions in the Economics Guide for Watershed Protection and Flood Prevention.

Crop and pasture damages were estimated in terms of reduced yields as a result of the water hazard. Benefits were calculated in terms of increased yields as a result of reducing the water hazard. Benefits were calculated using current normalized prices.

The installation cost of the project was estimated using current prices. The costs of all structural measures were amortized over the expected life of the project (100 years) using a 5 7/8 percent interest rate.

Secondary benefits are the values added over and above the direct benefits of the project as a result of activities "stemming from" the project. The value of local secondary benefits was derived by applying a 10 percent factor to the sum of all primary project benefits, excluding indirect.

Redevelopment benefits reflect increased local employment created by the project during the installation of structural measures. The value of local labor required for project installation is estimated to be 30 percent of the construction cost and 50 percent of the annual operation and maintenance. The value of local labor employment was amortized for 100 years at 5 7/8 percent interest. Redevelopment from O&M was calculated on the basis of full value immediately following construction and declining to zero in 25 years.

The value of land easement for channel work was estimated by using current land values for comparable land in the area. An estimated 59 acres will be needed at an estimated value of \$28,000.

Future road and bridge damages were estimated by projecting present damages which were determined from information from the county road department. Benefits were calculated as a reduction of future damages.

Fish and Wildlife

A one day field reconnaissance of the watershed was made by representatives of the Alabama Department of Conservation and Natural Resources, U. S. Fish and Wildlife Service, and the Soil Conservation Service. This group was composed of three biologists and one engineer. Existing fish and wildlife resources and the possible effects of the proposed project on these resources were discussed. No field work such as sampling fish population was conducted.

Sedimentation

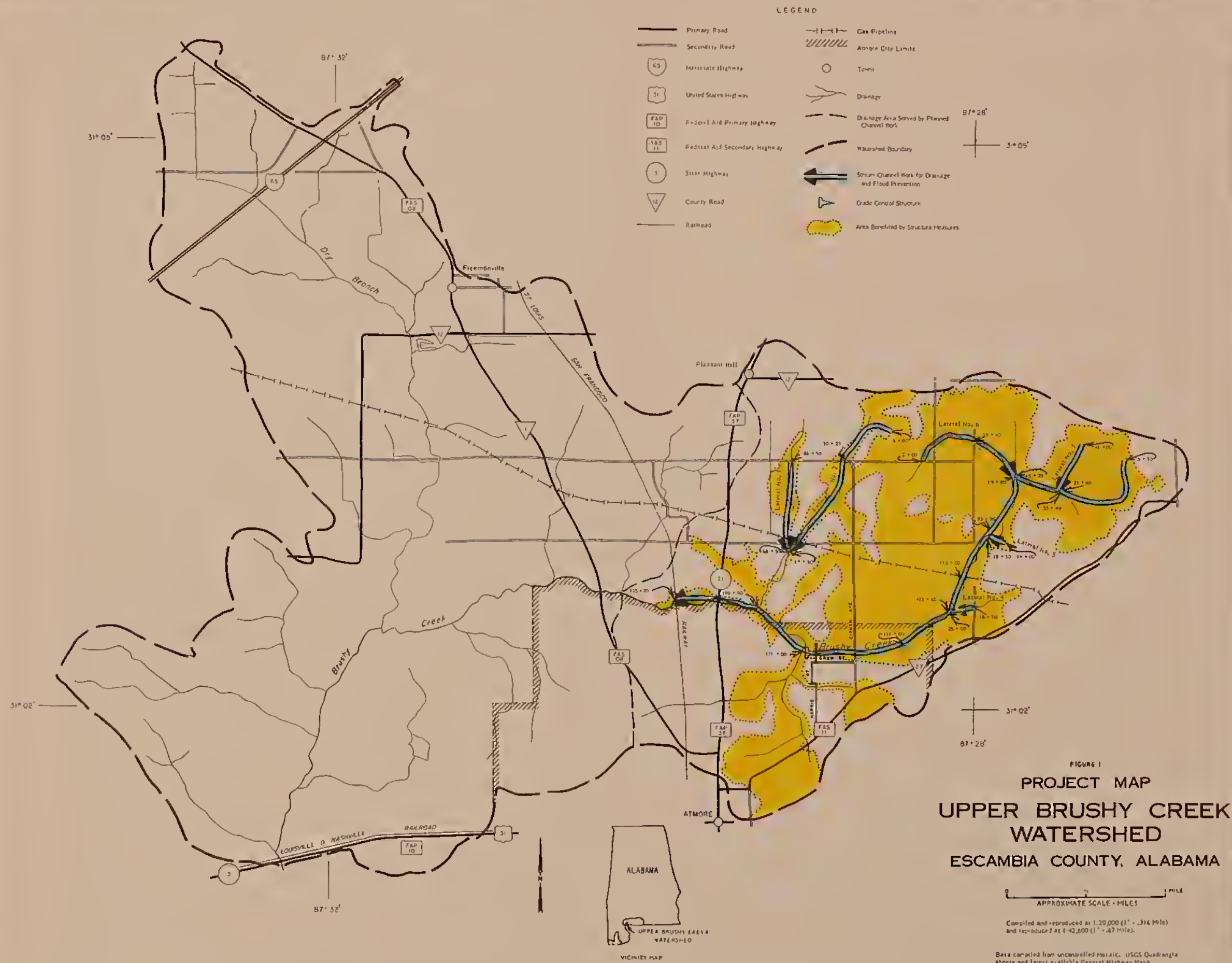
Land uses, cover conditions, percent slope, and length of slope were mapped in detail on the various soils of the watershed. Using the Universal Soil-Loss Prediction Equation, the present and future expected erosion rates were calculated. Erosion on pastures, forests,

urban, idle and miscellaneous lands is not a major problem. It was determined that the present gross erosion rate (7.03 tons per acre) on approximately 1,200 acres of the upland croplands exceeds the allowable maximum soil-loss tolerance level of about five tons per acre per year. Following land treatment on these croplands, the gross erosion rate will be lowered to 4.63 tons per acre per year.

Sediment delivery ratios were estimated using a curve relating size of drainage area and gross erosion in the Sand-Clay Hills Land Resource Area of Mississippi. Delivery ratios of 34 and 26 percent were used in calculating sediment at the mouths of the major problem area and total watershed respectively.

Archaeological, and Historical Values

Recently the University of Alabama, Department of Anthropology studied the watershed for possible archaeological or historical sites of importance that might be affected by the proposed project. The results of the study indicate that no such sites exist within the watershed area.





LEGEND

- CROP AND PASTURE
- PINE AND HARDWOOD
- SWEET GUM AND POPLAR
- POND CYPRESS
- URBAN AREA

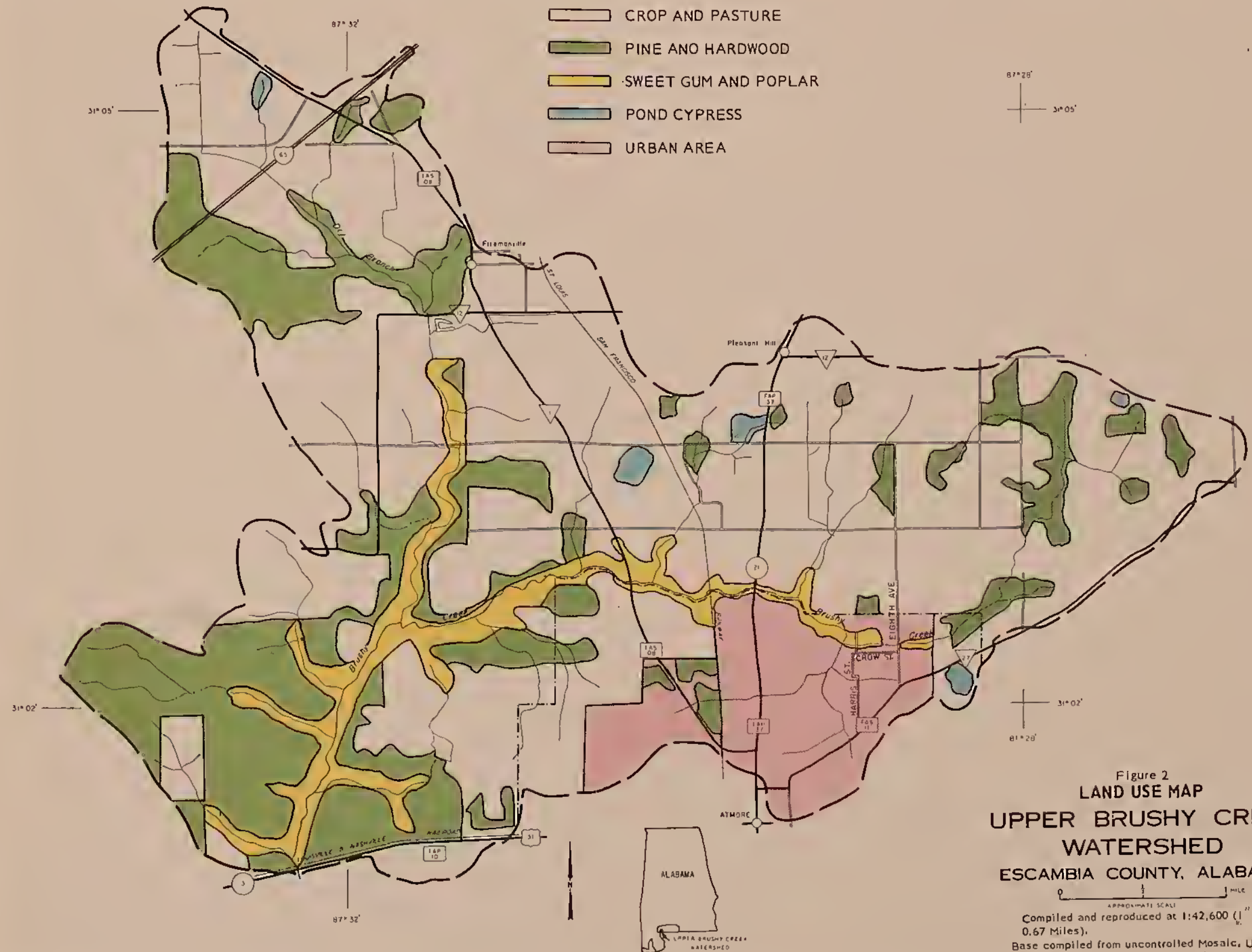
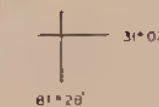
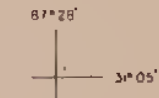


Figure 2
LAND USE MAP
UPPER BRUSHY CREEK
WATERSHED
ESCAMBIA COUNTY, ALABAMA

0 1 2 MILE
 APPROXIMATE SCALE
 Compiled and reproduced at 1:42,600 (1" = 0.67 Miles).

Base compiled from uncontrolled Mosaic, USGS
 Quadrangle sheets and latest available General
 Highway Maps.

MARCH 1974

4-R-33755

NOV 1971

4-R-31033



SOILS LEGEND

SYMBOL	NAME	% OF SLOPE
11	GRASMER SILTY CLAY	
31-A1	BOWIE FINE SANDY LOAM	0-2%
31-B1	BOWIE FINE SANDY LOAM	2-5%
33-A1	BENDDALE FINE SANDY LOAM	0-2%
33-B1	BENDDALE FINE SANDY LOAM	2-5%
33-C1	BENDDALE FINE SANDY LOAM	5-8%
39-A1	TIFTON FINE SANDY LOAM	0-2%
39-B1	TIFTON FINE SANDY LOAM	2-5%
46-A1	IRVINGTON FINE SANDY LOAM	0-2%
46-B1	IRVINGTON FINE SANDY LOAM	2-5%
60-D1	BENDDALE-ORANGEBURG COMPLEX, SLOPING	
70-B1	TROUP FINE SAND	0-5%
70-C1	TROUP FINE SAND	5-8%
80	BIBB SOILS	
82	GRADY LOAM	
85-B1	PLUMMER LOAMY SAND	0-5%
130-A1	GREENVILLE FINE SANDY LOAM	0-2%
130-B1	GREENVILLE FINE SANDY LOAM	2-5%
133-A1	ORANGEBURG FINE SANDY LOAM	0-2%
133-B1	ORANGEBURG FINE SANDY LOAM	0-5%
133-C1	ORANGEBURG FINE SANDY LOAM	5-8%
139-A1	RUSTON VERY FINE SANDY LOAM	0-2%
139-B1	RUSTON VERY FINE SANDY LOAM	2-5%
145-A1	ROBERTSDALE FINE SANDY LOAM	0-2%
146-A1	POARCH FINE SANDY LOAM	0-2%
239-A1	FREEMANVILLE FINE SANDY LOAM	0-2%
239-B1	FREEMANVILLE FINE SANDY LOAM	2-5%
239-C2	FREEMANVILLE FINE SANDY LOAM	5-8%
245-A1	ESCAMBIA FINE SANDY LOAM	0-3%
260-D1	ESTO-DOTHAN-WAGRAM COMPLEX, SLOPING	
285-A1	ATMORE SILT LOAM	0-3%

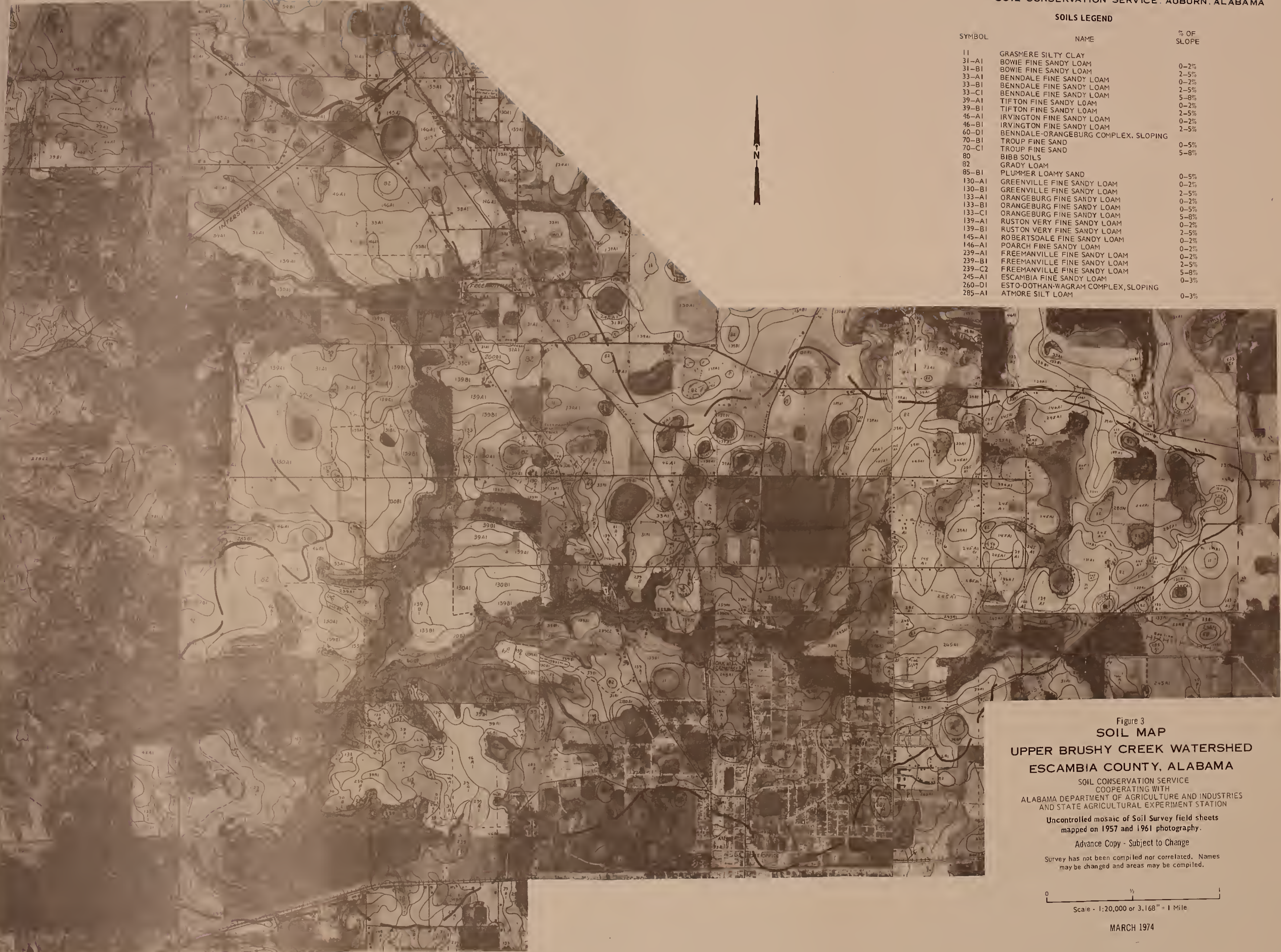


Figure 3
SOIL MAP
UPPER BRUSHY CREEK WATERSHED
ESCAMBIA COUNTY, ALABAMA
SOIL CONSERVATION SERVICE
COOPERATING WITH
ALABAMA DEPARTMENT OF AGRICULTURE AND INDUSTRIES
AND STATE AGRICULTURAL EXPERIMENT STATION
Uncontrolled mosaic of Soil Survey field sheets
mapped on 1957 and 1961 photography.
Advance Copy - Subject to Change
Survey has not been compiled nor correlated. Names
may be changed and areas may be compiled.

0 1/2 1
Scale - 1:20,000 or 3,168" = 1 Mile

MARCH 1974

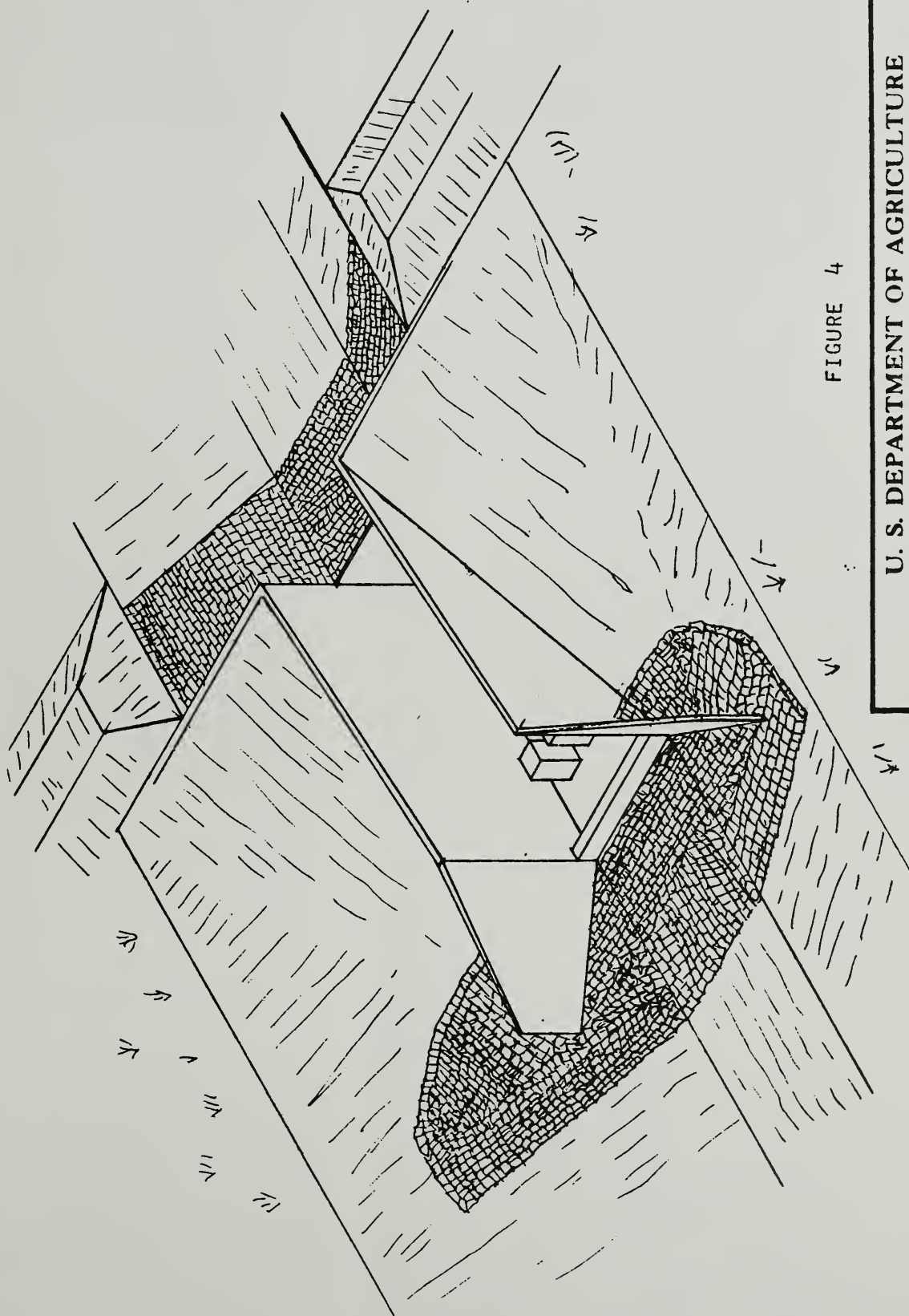


FIGURE 4

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

TYPICAL REINFORCED CONCRETE

DROP SPILLWAY

